IMPERIAL BUREAU
27 JAN. 1930
OF MYCOLOGY

1929.

QUEENSLAND.

# TWENTY-NINTH ANNUAL REPORT OF THE BUREAU OF SUGAR EXPERIMENT STATIONS.

## REPORT OF THE DIRECTOR

TO

THE HON. THE SECRETARY FOR AGRICULTURE AND STOCK

(*As required by "The Sugar Experiment Stations Act of* 1900").

**PRESENTED TO PARLIAMENT BY COMMAND.**

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# TWENTY-NINTH ANNUAL REPORT OF THE BUREAU OF SUGAR EXPERIMENT STATIONS.

## DIRECTOR'S REPORT.

TO THE HONOURABLE THE SECRETARY FOR AGRICULTURE AND STOCK.

SIR,—I have the honour to submit the Twenty-ninth Annual Report of the Bureau of Sugar Experiment Stations up to the 15th November, 1929.

H. T. EASTERBY,
Director.

Brisbane, 5th December, 1929.

## 1.—Introduction.

The production of raw sugar for the year 1927 was the record to that date, but 1928 saw a still larger production, the figures being—

| | Tons. |
|---|---|
| 1927 .. .. | 485,745 |
| 1928 .. .. | 520,620 |

The tonnage of cane per acre, however, was slightly below that of 1927, but the yield of sugar per acre was better. The tonnage of cane harvested amounted to 3,736,311 tons. The tons of cane required per ton of sugar were the lowest on record to that year, being 7·18. This figure has shown a constant improvement in recent years.

The quantity of sugar manufactured in 1928 was in excess of Australia's requirements, and 186,703 tons were exported.

The proportion which the sugar required for consumption in the Commonwealth of Australia bore to the total production in Queensland and New South Wales in 1928 was 64·2809 per cent. The net value of the 94 net titre surplus sugar sold abroad was £10 10s. per ton, a much lower figure than that obtained in 1926 and 1927. In respect of the raw sugar deemed to have been delivered and required in the Commonwealth of Australia, the Sugar Board declared a payment of 13s. 6d. in addition to the price of £26 prescribed for such sugar. The average payment that the Queensland and New South Wales sugar industry received for the whole crop was £20 17s. 11·3845d., which was lower than in 1926 and 1927.

The consumption of sugar in Australia has recently shown no increase, which may possibly be due to the more stringent financial position of the country.

The exports of sugar since 1924, when the first large surplus was made, are as under:—

| | Tons. |
|---|---|
| 1924 .. .. | 74,000 |
| 1925 .. .. | 211,000 |
| 1926 .. .. | 74,777 |
| 1927 .. .. | 152,384 |
| 1928 .. .. | 186,703 |
| 1929 (estimated) .. | 194,000 |

This export of sugar is of the greatest benefit to Australia as a whole, as millions of pounds have been received by this country during the past six years in payment therefor, increasing the Australian revenue and compensating for adverse trade balances.

Mr. Albert Townsend, the representative of the Commonwealth Government on the Export Sugar Committee, and an officer of the Commonwealth Trade and Customs Department, has been good enough to supply the following table of comparative prices brought up to present year:—

**Table showing that the increase in the Price of Sugar since 1914 has been less than that of any other constantly used commodity, together with the increase in the Basic wage.**

| Article. | July, 1914. | July, 1929. | Increased Percentage of 1929 over 1914. |
|---|---|---|---|
| | | | Per cent. |
| Sugar, per lb. .. .. .. .. .. .. .. .. | 3·0d. | 4·5d. | 50·0 |
| Butter, per lb. .. .. .. .. .. .. .. .. | 13·1d. | 25·05d. | 91·2 |
| Meat, per lb. (average) .. .. .. .. .. .. .. .. | 5·66d. | 8·73d. | 52·4 |
| Bread, 2-lb. loaf .. .. .. .. .. .. .. .. | 3·5d. | 5·70d. | 62·8 |
| Jam, per lb. .. .. .. .. .. .. .. .. | 4·1d. | 6·91d. | 68·5 |
| Coal, per ton (wholesale at wharf) .. .. .. .. .. .. | 23s. 9d. | 45s. 9d. | 92·6 |
| Milk, per quart .. .. .. .. .. .. .. .. | 4·7d. | 9·05d. | 92·5 |
| Basic wage, per week .. .. .. .. .. .. .. .. | £2 12s. | £4 15s. | 82·7 |

(All these prices apply to Sydney, except for coal which is the Melbourne price.)

It has been pointed out in previous reports that the production of sugar has been governed by the same laws as have influenced the rise in other foodstuffs quoted above. Yet sugar, which has increased less in price than any of the other commodities, is invariably selected by Southern critics, ignorant of the conditions, for general attack.

In addition to the export of sugar mentioned above, the following amounts of sugar have been estimated to have been exported in manufactured articles such as condensed milk, &c.:—

| | Tons. |
|---|---|
| 1924-1925 .. .. | 5,500 |
| 1925-1926 .. .. | 6,555 |
| 1926-1927 .. .. | 4,807 |
| 1927-1928 .. .. | 5,003 |
| 1928-1929 (estimated) | 5,786 |

## 2.—Approximate Estimate of the 1929 Crop.

The cane crop this season will not be quite so large as last year, due to frosts in Southern districts, long-continued dry weather in some areas, and considerable grub damage in Northern sugar localities. On the other hand, the commercial cane sugar in cane has been exceptionally high in the Northern areas, which fact should compensate largely for the decrease in the cane crops. No serious Labour troubles were experienced; crushing has proceeded smoothly up to date; and the transit of sugar ex ports was subject to no delays.

The following table gives the earlier estimate of the crop, together with that supplied by the mills at the end of October:—

**Estimated Crop of Cane, 1929 Season.**

| Mill. | Preliminary Estimate formed in June. | Approximate Estimate Furnished by Mills at end of October. | Remarks. |
|---|---|---|---|
| | Tons. | Tons. | |
| Mossman .. .. .. .. | 79,000 | 73,561 | Reduction due to dry weather |
| Hambledon .. .. .. | 203,000 | 218,000 | .. |
| Mulgrave .. .. .. .. | 195,000 | 215,000 | .. |
| Babinda .. .. .. .. | 200,000 | 215,000 | .. |
| Goondi .. .. .. .. | 180,000 | 184,000 | .. |
| South Johnstone .. .. .. | 195,000 | 220,000 | .. |
| Mourilyan .. .. .. | 155,000 | 151,000 | Reduction due to losses from grubs. |
| Tully .. .. .. .. | 230,000 | 206,000 | .. |
| Victoria .. .. .. .. | 225,000 | 215,000 | .. |
| Macknade .. .. .. | 190,000 | 157,000 | .. |
| Invicta .. .. .. .. | 71,000 | 82,000 | .. |
| Pioneer .. .. .. .. | 130,000 | 136,000 | .. |
| Kalamia .. .. .. .. | 175,000 | 179,000 | .. |
| Inkerman .. .. .. | 184,520 | 167,000 | .. |
| Proserpine .. .. .. | 92,000 | 98,000 | .. |
| Cattle Creek .. .. .. | 52,000 | 46,665 | Reduction due to dry weather |
| Racecourse .. .. .. | 100,000 | 82,000 | Reduction due to dry weather |
| Farleigh .. .. .. .. | 95,000 | 71,422 | Reduction due to dry weather |
| North Eton .. .. .. | 60,000 | 55,000 | Reduction due to dry weather |
| Marian .. .. .. .. | 85,000 | 88,429 | .. |
| Pleystowe .. .. .. | 105,000 | 95,500 | Reduction due to dry weather |
| Plane Creek .. .. .. | 100,000 | 98,000 | Reduction due to dry weather |
| Qunaba .. .. .. .. | 30,000 | 36,999 | .. |
| Millaquin .. .. .. .. | 90,000 | 94,000 | .. |
| Bingera .. .. .. .. | 85,000 | 87,000 | .. |
| Fairymead .. .. .. | 90,000 | 94,000 | .. |
| Gin Gin .. .. .. .. | 25,000 | 27,600 | .. |
| Childers .. .. .. .. | 75,000 | 58,000 | .. |
| Isis .. .. .. .. | 67,500 | 61,500 | Reduction due to dry weather |
| Maryborough .. .. .. | 17,500 | 20,000 | .. |
| Mount Bauple .. .. .. | 25,000 | 23,200 | .. |
| Moreton .. .. .. .. | 55,000 | 48,000 | .. |
| Rocky Point .. .. .. | 6,000 | 10,000 | .. |
| Alberton .. .. .. .. | 750 | 872 | .. |
| Eagleby .. .. .. .. | 1,500 | 1,325 | .. |
| Total .. .. | 3,670,730 | 3,616,073 | |

Should this estimate be realised, the cane crop should amount to about 3,616,073 tons. If we assume, in view of the higher sugar content in North Queensland, that an average of only 7 tons of cane will be required to make 1 ton of 94 net titre sugar, the yield of such sugar will approximately be in the region of 516,000 tons, which would be about 4,000 tons less than manufactured last year.

It is anticipated that the yield of sugar in New South Wales this season will be about 19,500 tons, which may make the Australian production of raw sugar approximately 535,000 tons of 94 n.t.

The Victorian sugar factory also manufactured 2,108 tons of white granulated sugar from beet. The sugar content in the Victorian beet crop this year was also exceptionally high, averaging 17·94 per cent.

### COMPARATIVE PROGRESS OF THE INDUSTRY DURING THE PAST THIRTY YEARS.

It is interesting to look back thirty years and note the solid development of the sugar industry in Queensland. For this purpose a comparison between 1899 and 1928 is given hereunder:—

| Year. | Acres Cultivated. | Acres Crushed. | Yield. | |
|---|---|---|---|---|
| | | | Tons Cane. | Tons Sugar. |
| 1899 .. .. .. | 110,657 | 79,435 | 1,176,466 | 123,289 |
| 1928 .. .. .. | 283,476 | 215,674 | 3,736,311 | 520,620 |

In 1899, the yield of sugar per acre was 1·55 tons, and it required 9·54 tons of cane to manufacture 1 ton of 88 n.t. sugar; this figure would, of course, have been higher had 94 n.t. sugar been the standard at that time. In 1928, the yield of sugar per acre had reached 2·41 tons, and the tons of cane required to make 1 ton of 94 n.t. sugar had been reduced to 7·18.

## 2. Approximate Estimate of the 1929 Crop—*continued.*

It will be noted from the above table that the acreage has much more than doubled, and the yield of sugar per acre is much higher. The latter fact is largely due to the greater efficiency of the sugar-mills in recovering more sugar per acre than in former days.

The following tables show the gradual improvement since 1899:—

**Table showing Total Acres Cultivated and Crushed and Total Yields of Cane and Sugar per Acre for a Period of Thirty Years.**

| Year. | Acres Cultivated. | Acres Crushed. | Yield. | |
|---|---|---|---|---|
| | | | Tons Cane. | Tons Sugar. |
| 1899 | 110,657 | 79,435 | 1,176,466 | 123,289 |
| 1900 | 108,535 | 72,651 | 848,328 | 92,554 |
| 1901 | 112,031 | 78,160 | 1,180,091 | 120,858 |
| 1902 | 85,838 | 59,102 | 641,927 | 76,626 |
| 1903 | 111,536 | 60,375 | 823,875 | 91,828 |
| 1904 | 120,317 | 82,741 | 1,326,989 | 147,688 |
| 1905 | 134,107 | 96,093 | 1,415,745 | 152,722 |
| 1906 | 133,284 | 98,194 | 1,728,780 | 184,377 |
| 1907 | 126,810 | 94,384 | 1,665,028 | 188,307 |
| 1908 | 123,902 | 92,219 | 1,433,315 | 151,098 |
| 1909 | 128,178 | 80,095 | 1,163,569 | 134,584 |
| 1910 | 141,779 | 94,641 | 1,840,447 | 210,756 |
| 1911 | 130,376 | 95,766 | 1,534,451 | 173,296 |
| 1912 | 141,652 | 78,142 | 994,212 | 113,060 |
| 1913 | 147,743 | 102,803 | 2,085,588 | 242,837 |
| 1914 | 161,195 | 108,013 | 1,922,633 | 225,847 |
| 1915 | 153,027 | 94,459 | 1,152,516 | 140,496 |
| 1916 | 167,221 | 75,914 | 1,579,514 | 176,973 |
| 1917 | 175,762 | 108,707 | 2,704,211 | 307,714 |
| 1918 | 160,534 | 111,572 | 1,674,829 | 189,978 |
| 1919 | 148,469 | 84,877 | 1,258,760 | 162,136 |
| 1920 | 162,619 | 89,142 | 1,339,455 | 167,401 |
| 1921 | 184,513 | 122,956 | 2,287,416 | 282,198 |
| 1922 | 202,303 | 140,850 | 2,167,990 | 287,785 |
| 1923 | 219,965 | 138,742 | 2,045,808 | 269,175 |
| 1924 | 253,519 | 167,649 | 3,171,341 | 409,136 |
| 1925 | 269,509 | 189,466 | 3,668,252 | 485,585 |
| 1926 | 266,519 | 189,312 | 2,952,662 | 389,272 |
| 1927 | 274,838 | 203,748 | 3,555,827 | 485,745 |
| 1928 | 283,476 | 215,674 | 3,736,311 | *520,620 |

* This is raw sugar of 94 net titre.

**Table showing Yield of Cane and Sugar per Acre and Tons of Cane required to make One Ton of Sugar during Thirty Years.**

| Year. | Tons Cane per Acre. | Tons Sugar per Acre. | Tons Cane to 1 Ton Sugar. |
|---|---|---|---|
| 1899 | 14·81 | 1·55 | 9·54 |
| 1900 | 11·68 | 1·28 | 9·44 |
| 1901 | 15·10 | 1·55 | 9·76 |
| 1902 | 10·86 | 1·30 | 8·38 |
| 1903 | 13·65 | 1·52 | 8·97 |
| 1904 | 16·04 | 1·78 | 8·99 |
| 1905 | 14·73 | 1·59 | 9·27 |
| 1906 | 17·61 | 1·88 | 9·38 |
| 1907 | 17·64 | 2·00 | 8·84 |
| 1908 | 15·54 | 1·64 | 9·49 |
| Ten Years' Average | 15·04 | 1·63 | 9·20 |
| 1909 | 14·53 | 1·68 | 8·65 |
| 1910 | 19·45 | 2·23 | 8·73 |
| 1911 | 16·02 | 1·81 | 8·85 |
| 1912 | 12·72 | 1·45 | 8·79 |
| 1913 | 20·29 | 2·36 | 8·59 |
| 1914 | 17·80 | 2·09 | 8·51 |
| 1915 | 12·20 | 1·49 | 8·20 |
| 1916 | 20·81 | 2·33 | 8·93 |
| 1917 | 24·88 | 2·83 | 8·79 |
| 1918 | 15·01 | 1·70 | 8·82 |
| Ten Years' Average | 17·52 | 2·01 | 8·69 |
| 1919 | 14·83 | 1·91 | 7·76 |
| 1920 | 15·03 | 1·88 | 8·0 |
| 1921 | 18·60 | 2·30 | 8·11 |
| 1922 | 15·39 | 2·04 | 7·53 |
| 1923 | 14·75 | 1·94 | 7·60 |
| 1924 | 18·92 | 2·44 | 7·75 |
| 1925 | 19·36 | 2·56 | 7·55 |
| 1926 | 15·45 | 2·06 | 7·52 |
| 1927 | 17·45 | 2·38 | 7·32 |
| 1928 | 17·32 | 2·41 | 7·18 |
| Ten Years' Average | 16·74 | 2·24 | 7·46 |

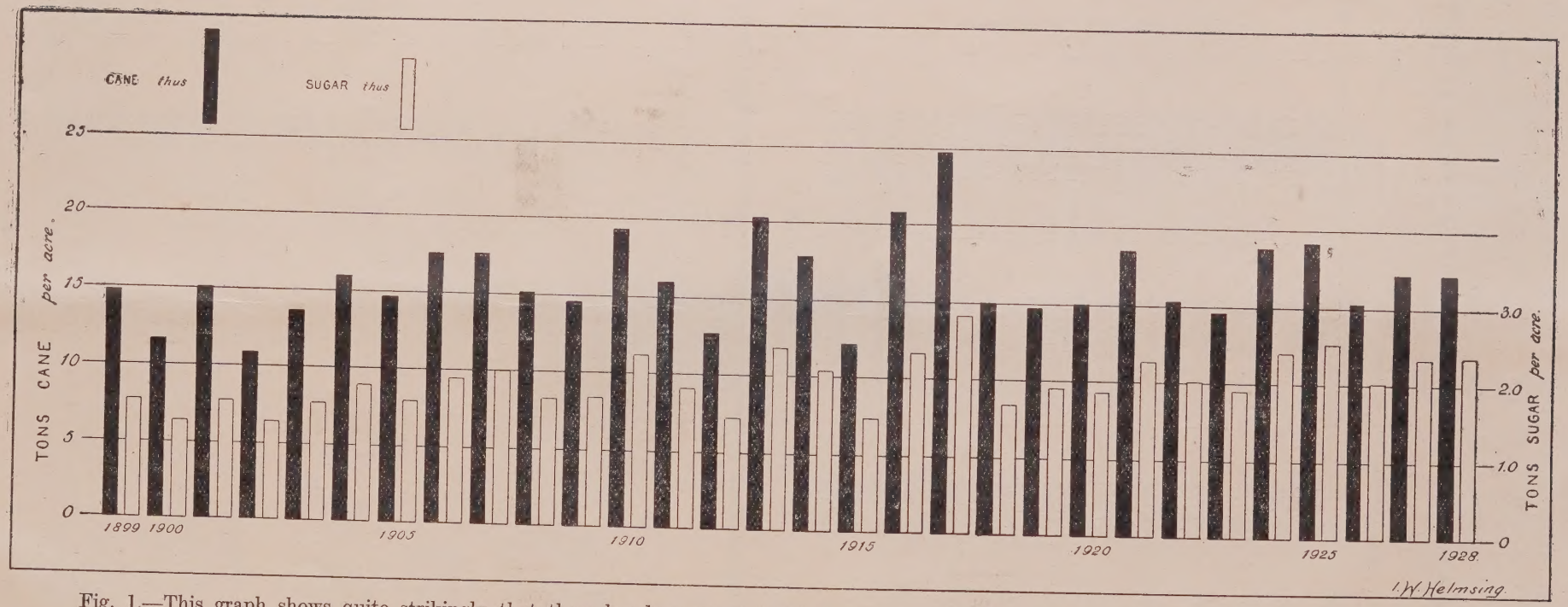
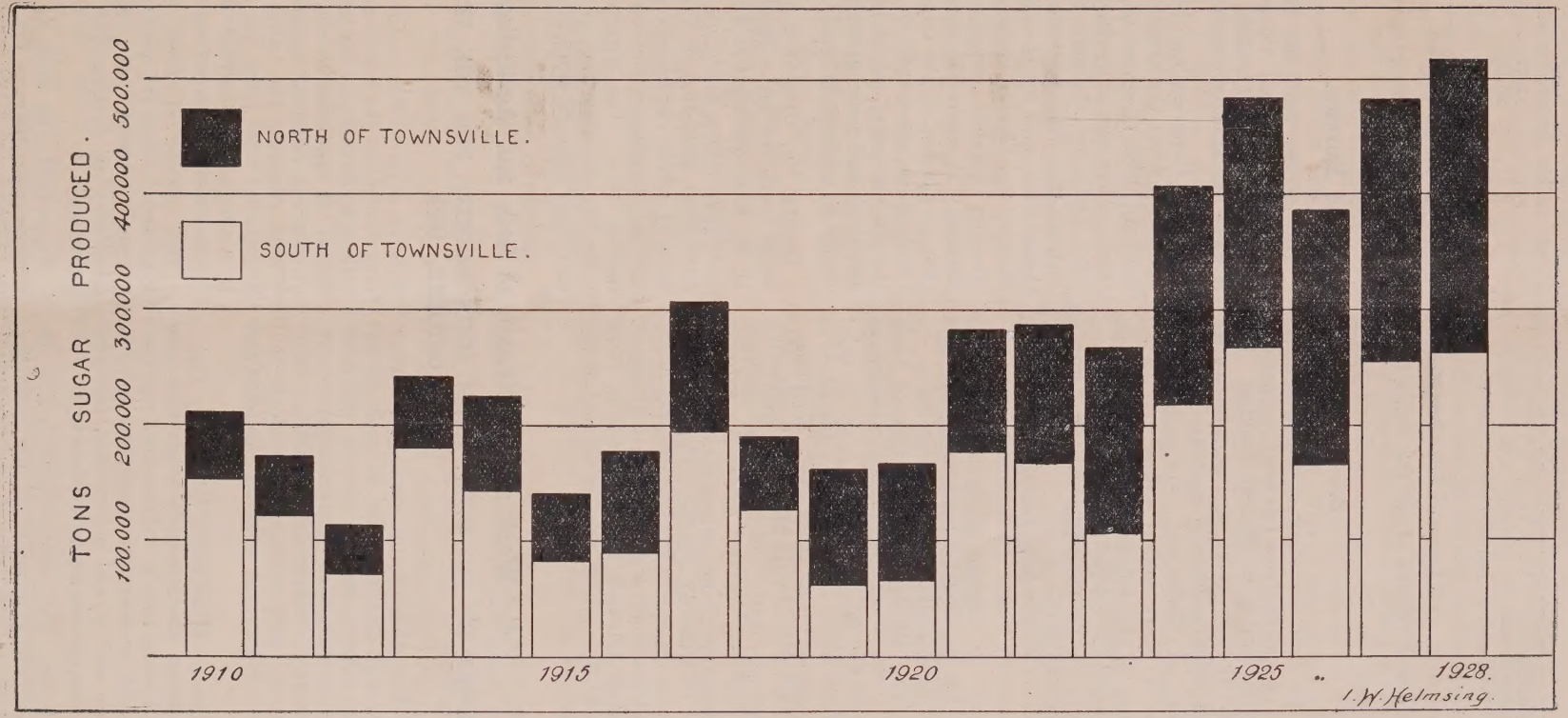



Fig. 1.—This graph shows quite strikingly that there has been no material improvement in the average tonnage of cane per acre produced in Queensland during the past decade. There is, however, a very decided improvement in the production of sugar per acre. This is attributable in part to the growing of improved varieties with higher sugar content, and to the increased mill efficiency, resulting in higher extractions and recoveries.

PROGRESS MADE IN THE DEVELOPMENT OF THE SUGAR INDUSTRY IN THOSE DISTRICTS SITUATE NORTH OF TOWNSVILLE SINCE 1910.

The above areas, with their high rainfalls and humid conditions, have made great progress in recent years, as the following graph will show :—



**2. Approximate Estimate of the 1929 Crop**—*continued.*

**Comparison of Tonnages of Cane and Sugar Produced in Different Areas of Queensland, comprising the Average Yields per Acre from 1902 to 1927.**

| —— | Cane. | Sugar. |
|---|---|---|
| North of Townsville .. .. .. .. .. .. .. .. | 17·47 | 2·20 |
| Lower Burdekin .. .. .. .. .. .. .. .. | 20·19 | 2·57 |
| *Mackay and South .. .. .. .. .. .. .. .. | 15·07 | 1·65 |

* The small districts of Moreton and Beenleigh are not included.

The above figures show the influence of irrigation in the Lower Burdekin district.

## 3.—General Work of the Bureau.

During the year the work of the Bureau of Sugar Experiment Stations has been reorganised in order to promote more efficient working. For this purpose, four divisions have been instituted, with the officers mentioned in charge:—

Division of Soils and Agriculture—Dr. H. W. Kerr, Soils Chemist.
Division of Pathology—Mr. A. F. Bell, Sugar Pathologist.
Division of Entomology—Mr. E. Jarvis, Entomologist.
Division of Sugar Mill Technology—Mr. N. Bennett, Sugar Technologist.

The officer in charge of each division is responsible for the work of his branch, and lays out same in consultation with the Director.

Reports from the officers in charge of their respective divisions will be found immediately following this section.

Sugar Experiment Stations are established at South Johnstone, near Innisfail (Northern), Mackay (Central), and Bundaberg (Southern). These Stations have chemical laboratories attached. Laboratories and offices for entomological research work are situated at Meringa, near Cairns (Northern), Mackay (Central), and Bundaberg (Southern). Laboratories for investigation and research work on soils and sugar-cane pathology are now being erected in Brisbane, and will be ready for use at the end of the present year.

During the year the Director attended the Third International Congress of Sugar Cane Technologists, held in Java, and a report on this subject has already been published.

At the Congress the Director presented an invitation from the Queensland Government to hold the 1932 Congress in the State of Queensland. This was supported by the Queensland Cane Growers' Council, by Dr. A. J. Gibson representing the Australian Sugar Producers' Association, and by the Queensland Society of Sugar Cane Technologists, represented by Mr. Norman Bennett, Sugar Technologist to this Bureau. It was after much discussion decided that, as the aim of the Congress was to hold the Conferences alternately in the two hemispheres, the 1932 meeting would be held in Porto Rico, but there was every probability that Queensland would be selected in 1935.

During the Director's absence in Java, and when away on leave earlier in the year, Dr. H. W. Kerr officiated as Acting Director. Many new suggestions made by him to the Director have been embodied in the present report, the form of which has been considerably changed in view of the altered methods adopted for experimental work. The Director wishes to acknowledge the able assistance of Dr. Kerr both in this and other respects since his return from abroad.

## 4.—Work of the Division of Soils and Agriculture.

### REPORT BY DR. H. W. KERR, SOILS CHEMIST, FOR THE YEAR ENDING 31st OCTOBER, 1929.

Since the inception of this division last year, under the charge of the writer, an attempt has been made to expand our activities in this field. The division embraces the agricultural experimental work of the Experiment Stations, cane-breeding work, and chemical, physical, and biological investigational work on the soils and crops.

In the absence of adequate laboratory facilities in Brisbane, the scientific work has been hampered to some extent. However, the new premises should be ready for occupation early in the New Year, and we will be provided then with a complete and up-to-date soils laboratory.

Our efforts have been concentrated during the past year on the expansion of our extension service—the demonstration of the fertiliser, cultural and varietal requirements of the sugar soils, by field experiments conducted under our direct personal supervision. We have long appreciated the fact that a few district experiment stations have their shortcomings when data of a particular nature are required. We may determine the fertiliser requirements of the soil type found on the station lands, but the degree of applicability of these results to soils of a widely different nature may be very slight. Whilst realising the value of the more widely distributed trial plots, the organisation has not been adequate in the past to cope with the added duties which such a system would thrust upon it.

The scheme of farm experimentation was launched during the past season, and the staff of the division has acquitted itself quite admirably in getting the project successfully under way.

An appeal was made to the farmers of the various cane districts for co-operative aid, and the response was most gratifying. We were able to select forty-six farms carrying soil types of major importance, and on these fertility trials have now been laid out. In general, a rather uniform type of trial was chosen, which aimed at giving us information regarding response to

**4. Work of the Division of Soils and Agriculture**—*continued.*

plant food constituents, singly and in combination. The experimental plan was in general the 5 x 5 Latin square, with a few randomised block trials where liming was combined with the fertiliser tests. Naturally, we do not expect that all of these trials will be carried through to a conclusion; climatic factors (frosts, droughts, and floods) as well as other accidental factors will enter to vitiate some of our results, but it is hoped that the majority of the trials will be harvested, and that we will be able to draw valuable conclusions from the data recorded.

The following list shows the names and locations of the farmers who are co-operating with us in this work:—

*Northern Division.*—Messrs. Pringle Bros., Mossman; L. R. Herne, Mossman; C. Baio, Sawmill Pocket, Hambledon; J. Walker, Meerawa; A. J. Kelly, Aloomba; Kearn and Co., Cucania; R. Matthews, Pawngilly; W. Thiele, Pawngilly; J. P. McGowan, Daradgee; M. Caldera, Mourilyan; S. Pagano, Mourilyan; J. A. Wolff, South Johnstone; W. Jones, Silkwood; Allison Bros., Midgenoo; S. J. French, Midgenoo; Cox and Parker, Ayr; and F. Laun, Ayr.

*Central Division.*—Messrs. E. Evans, Farleigh; J. Trevaskis, Farleigh; J. Gibson, Racecourse; H. Single, Foulden; Palms Estate, Alexandra; Palms Estate, Palms; Laws and Baker, North Eton; T. W. Peele, North Eton; H. J. Hansen, Dumbleton; H. Ivers, Rosella; C. H. Walz, Marian; P. Petersen, Sarina; P. Brooks, Sarina; E. K. Glen, Pleystowe; H. R. Swanson, Mackay; and H. Rowe, Mirani.

*Southern Division.*—Messrs. Gahn Bros., Tantitha; Qunaba Plantation, Woongarra; P. Petersen, Bingera; C. N. Dahl, Bundaberg; Eardley Bros., Bundaberg; Burrage Bros., Maroondan; A. Adie, Cordalba; C. H. Tench, Pialba; J. Mungomery, Takura; J. O'Mara, Bauple, T. Beatty, Bauple, C. Trewin, Maroochy River; and F. W. Kirk, Nambour.

We would also like to record our thanks and appreciation for the co-operation of the following fertiliser distributing companies, in making available all the fertiliser required for the trials, free of cost: —

A.C.F. and Shirley's Fertilizers, Limited;
Imperial Chemical Industries (Aust.), Limited;
Dalgety and Co.

The fertiliser has been passed on gratuitously to the growers concerned, in compensation for the added duties which the experiments have imposed on them.

### Variety Trials.

The desirability for improved methods of testing out new varieties has been appreciated. The principle of distributing varieties by passing out a few sets of each cane to desirous growers has much to be said against it. It is of little benefit to the grower himself, and it gives us no method of gauging the relative values of the new cane and the old standard varieties. The system of varietal trials on a carefully planned system has been brought in, and twenty-one such experimental blocks were set out during the past season.

Eleven trials with our seedling S.J. 4 were commenced in the mill districts from Tully North. This cane has shown considerable promise under Northern conditions, but its disease susceptible qualities rather rule it out in the Southern areas.

Four trials with P.O.J. 2714 and other promising varieties are located in the Mackay area. From present appearances, P.O.J. 2714 would seem to be a coming variety in this district.

Seven trials embracing those varieties which have shown the highest degree of resistance to gumming disease have been set out in the Bundaberg and Nambour areas. We are hopeful that the Co. series, introduced from India, will maintain the promise which they have shown in Bundaberg and elsewhere.

By agreement with the co-operating growers in each case, the Director reserves the right of repurchase of three-quarters of the resulting crop yields, so that farmers in the neighbourhood who desire plants next year may be provided for.

Our aim is to have new varieties adequately tested out as soon as possible, to discard those which are inferior, and work for the rapid propagation of the superior canes under conditions favourable for their growth.

### Field Staff.

The expansion in field work occasioned by the adoption of the farm trial system has necessitated an increase in the field staff. This is now constituted as follows:—

Mr. G. Bates, Northern District (Mossman to Tully);
Mr. A. P. Gibson, Northern District (Ingham to Proserpine);
Mr. E. H. Osborn, Central District (Mackay);
Mr. J. C. Murray, Southern District (Bundaberg to Beenleigh).

In addition, the services of the chemists in charge of the stations have been requisitioned on occasions to assist in the laying out and supervision of certain trials during the planting season.

The field staff is scarcely adequate even now to allow of the close co-operation between grower and Experiment Stations which is so desirable if we are to secure the desired experimental data and disseminate our information to assist growers. Our aim would be to divide the cane-growing area into, say, six districts, with a field officer located in each, so that he would acquire a more intimate knowledge of his local conditions and that personal contact with individual growers which makes for the most successful co-operation.

### Soil Investigations.

Many pressing problems which await investigation have been held over pending the completion of the new Soils Laboratory. However, a considerable amount of work has been put through, both at the station laboratories and in the general Chemical Laboratory in Brisbane. We would record our appreciation of the courtesy of Mr. J. C. Brünnich in making the latter available for our studies.

The policy of general chemical analysis of soils which has been pursued in the past has been suspended. Only those samples are analysed which have been collected by our field officers after a detailed field inspection.

**4. Work of the Division of Soils and Agriculture**—*continued.*

Samples have been taken from the "check" (no treatment) plots of our fertility trials, and analyses of these have been made, so that we may attempt to correlate laboratory figures with the soil response observed in the field. Fertility tests by chemical analyses of soils may be carried out with much greater facility than is possible with the field trial method; but the latter is the truly reliable one, and we must prove our laboratory methods against the field trial method to establish the degree of reliability of our chemical tests.

Such a proven test is that for the determination of soil acidity, and the need of the soil for lime. A large number of these tests have been made during the past year, and it is gratifying to find that growers on the acid soils of North Queensland have been keen for our advice on this phase of soil treatment.

It is our plan to establish useful tests on fertility, and then apply them on a soil survey scale. Thus, in the humid tropical belt we find the lime-deficient soils; we plan then to carry out an intensive survey of these lands, taking one sample from, say, each 10 acres, and, from the data accumulated, construct a map of the districts. Reference to this map will then show the need or otherwise for lime and phosphates on a particular farm or block without recourse to further analysis.

A trial area of 2 square miles in the Innisfail district will be sampled on this plan in the immediate future, and when the value of the method is definitely established it will be extended to embrace all the sugar soils of the North. Similar work will be undertaken for the Central and Southern area when a determination has been made of the probable corrective treatments necessary.

A complete study of the soils and waters of our irrigated areas was projected some time ago, but this had to be postponed for the want of a research assistant to carry out the studies. With the appointment of a suitable officer this project will now be put under way.

One phase of investigational work which has been almost completely neglected both here and abroad is that of the influence of green manures, trash, and the by-products of manufacture (molasses and press-cake) as fertilisers and soil ameliorants. Field and laboratory tests will be made into the effect of these materials when added to the soil, and it is felt that the results will be of very considerable practical value.

A summary of the work performed at the Brisbane Laboratory during the past year is as follows:—

| | |
|---|---|
| Soils .. .. .. | 137 |
| Limestones .. .. | 9 |
| Rocks .. .. .. | 3 |
| Waters .. .. .. | 4 |
| Press-cakes .. .. | 3 |
| Molasses, massecuites, syrups, and liquors | 7 |
| Boiler scales .. .. | 3 |
| Total .. .. | 166 |

The major portion of the work was carried out by the Analyst to the Bureau (Mr. C. R. von Stieglitz).

### Cane Breeding.

An attempt has been made during the past year to increase the number of seedlings raised annually. We were rather unfortunate in having cool, dry conditions during the breeding months, and the percentage of germinations was decidedly low.

Conditions at Mackay and Bundaberg do not permit of our making crosses at these stations; canes do not arrow freely, and the flowers are generally sterile. To enable the raising of seedlings in these areas to be tested directly under local conditions, it is necessary to plant out fuzz from arrows raised at South Johnstone. A preliminary trial of this method was made during the past winter, but the results were disappointing. Apparently the low temperatures experienced had an adverse effect, and suitable provision will be made in the coming season for artificial heating of the germination flats.

The practicability of the transport of germinated flats from South Johnstone will also be tested.

The quality of the breeding material at South Johnstone has been materially improved by the recent introduction of a selection of the varieties which have given such pronounced success in Java. These will be employed in crosses with the best varieties in Queensland, and we look for greater success in our future efforts.

Of the seedlings raised in 1927, sixty-eight were selected for further trials, and several of them showed up favourably in their yields for the 1929 harvest. A further selection has been made of ten of this number. These will now be set out in a preliminary yield trial.

The seedlings of the 1928 propagation were not so flattering, but a few of these show distinct promise. One of particular interest is a Uba x Badila seedling, the performance of which will be followed closely.

The whole of the breeding work has been performed by our Plant Breeder, Mr. E. J. Barke. He has performed these most exacting and tedious duties in a very creditable manner.

### Work of the Experiment Stations.

The field trials and laboratory work of the stations were continued, and some valuable results have been gathered. This applies particularly to the results from the South Johnstone Station; climatic conditions in the Central and Southern districts throughout the year were rather unfavourable for crop growth, and this is reflected in the crop yields.

A detailed report of the results obtained follows.

## NORTHERN SUGAR EXPERIMENT STATION, SOUTH JOHNSTONE.

MR. E. J. BARKE, CHEMIST IN CHARGE.

The experimental work carried out at this station for the past year has been very successful, and the results obtained should find wide application under similar conditions throughout the Northern cane areas.

The following is a summary of the meteorological data and crop results for the past year :—

### METEOROLOGICAL.

The weather conditions during the early planting months of April, May, and June were most favourable, and excellent germinations were obtained. The total rainfall for these three months amounted to 17·84 inches, and was evenly distributed over this period. The late planting months were not so favourable, as, although a fall of 3·66 inches was recorded in August, only 12 points fell during September, and this was followed by 8 points in October. Growing conditions improved rapidly during November 1928, and after a fall of 13 inches good progress was made. Heavy soaking rains fell during December 1928, and with high humid conditions the cane made fast growth and was well advanced in January 1929. A total of 110·05 inches of rain fell during the next three months, and with high temperatures ideal growing conditions were experienced. The rainfall during the remainder of the season was below the average, but in no way retarded growth, and the crops harvested this year should be the largest on record.

The following are the rainfall records taken at this station since the year 1919 :—

| Year. | Rainfall in Inches. | Year. | Rainfall in Inches. |
|---|---|---|---|
| 1919 .. .. .. | 97·61 | 1925 .. .. .. | 118·94 |
| 1920 .. .. .. | 123·92 | 1926 .. .. .. | 77·50 |
| 1921 .. .. .. | 202·52 | 1927 .. .. .. | 138·11 |
| 1922 .. .. .. | 107·14 | 1928 .. .. .. | 118·63 |
| 1923 .. .. .. | 84·78 | 1929 (9 months) .. | 123·27 |
| 1924 .. .. .. | 146·71 | | |

**Abstract of Meteorological Observations made at the Northern Sugar Experiment Station, South Johnstone, from 1st September, 1928, to 31st August, 1929—Covering Period of Growth of Experiment Canes.**

| Month. | Rainfall in Inches. | Number of Wet Days. | Average Rainfall, 9 Years, 1920–1928. | Highest Shade Maximum. | Lowest Shade Maximum. | Mean Shade Maximum. | Highest Shade Minimum. | Lowest Shade Minimum. | Mean Shade Minimum. | Lowest Terrestrial Minimum. | Mean Terrestrial Minimum. | Mean Diurnal Range. | Mean Temperature, 9 a.m. | Mean Relative Humidity of the Air, 9 a.m. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| September 1928 | 0·12 | 5 | 3·96 | 90·0 | 82·0 | 84·8 | 70·0 | 55·4 | 60·9 | 53·0 | 58·5 | 23·9 | 74·8 | 76·0 |
| October 1928 .. | 0·08 | 4 | 2·55 | 93·9 | 85·1 | 89·9 | 75·2 | 57·0 | 65·2 | 54·2 | 63·2 | 24·7 | 81·6 | 64·0 |
| November 1928 | 13·25 | 19 | 4·14 | 91·3 | 80·0 | 86·7 | 73·6 | 63·0 | 69·5 | 62·0 | 68·0 | 17·2 | 79·9 | 76·0 |
| December 1928 .. | 9·87 | 16 | 10·51 | 100·8 | 83·7 | 90·8 | 76·8 | 60·7 | 71·9 | 59·0 | 70·7 | 18·9 | 83·5 | 75·0 |
| January 1929 .. | 43·11 | 19 | 17·22 | 97·8 | 81·1 | 90·0 | 78·5 | 63·4 | 73·7 | 62·8 | 72·3 | 16·3 | 81·8 | 81·8 |
| February 1929 .. | 32·88 | 17 | 22·66 | 95·2 | 83·5 | 90·4 | 76·5 | 68·5 | 72·7 | 67·5 | 71·3 | 17·7 | 83·1 | 82·0 |
| March 1929 .. | 34·06 | 23 | 29·08 | 98·9 | 83·9 | 88·8 | 74·7 | 66·1 | 72·1 | 65·9 | 71·3 | 16·7 | 80·1 | 86·0 |
| April 1929 .. | 3·49 | 13 | 15·02 | 91·1 | 78·0 | 84·8 | 73·4 | 47·3 | 63·8 | 46·0 | 62·1 | 21·0 | 75·0 | 80·0 |
| May 1929 .. | 2·52 | 15 | 8·88 | 85·0 | 76·0 | 80·2 | 67·8 | 46·0 | 58·4 | 44·8 | 56·8 | 21·8 | 68·5 | 83·2 |
| June 1929 .. | 2·26 | 9 | 6·44 | 82·2 | 68·5 | 77·4 | 64·5 | 48·0 | 56·6 | 45·8 | 54·6 | 20·8 | 66·8 | 82·2 |
| July 1929 .. | 1·20 | 16 | 3·92 | 86·5 | 72·0 | 76·3 | 64·5 | 43·8 | 52·8 | 41·0 | 50·6 | 23·5 | 65·2 | 82·0 |
| August 1929 .. | 2·16 | 15 | 2·61 | 83·5 | 75·0 | 78·5 | 66·8 | 44·0 | 57·8 | 42·0 | 56·0 | 20·7 | 69·0 | 83·8 |
| | 145·00 | 171 | 126·99 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | *79·3 |

* Average.

### Experiments dealt with in this Section of the Report.

1. Conclusion of experiments with fertilisers—Badila, third ratoons.

2. Conclusion of experiments with Badila cane, of which top plants, middle plants, and bottom plants were separately planted—second ratoon crop.

3. Conclusion of experiments with fertilisers and methods of applying—Badila, second ratoons.

4. Continuation of subsoiling and fertilising experiments—Badila, first ratoons.

5. Continuation of experiments to test the value of different quantities of lime—Badila, first ratoons.

6. Checker board trials with coral lime—Badila, plant cane.

7. Experiments in soaking plants in different solutions before planting—Badila, plant cane.

8. Checkerboard trials with four South Johnstone Seedling Canes and N.G. 15 (Badila).

**Work of the Northern Sugar Experiment Station**—*continued.*

## FERTILISER TRIAL (Third Ratoon Crop).

| |
|---|
| 1. 500 lb. basic superphosphate. |
| 2. 500 lb. meatworks. |
| 3. 200 lb. basic superphosphate.<br>100 lb. sulphate of ammonia.<br>200 lb. nitrate of soda. |
| 4. No manure. |
| 5. 500 lb. sulphate of potash. |
| 6. 250 lb. sulphate of ammonia.<br>250 lb. nitrate of soda. |

*Variety.*—Badila.

*Harvested.*—September 1929.

*Age of crop.*—11 months.

*Single plots* of each treatment.

*Plots.*—0·287 acre.

*Object.*—To test the action of mixed fertilisers as against single fertiliser materials containing nitrogen, phosphoric acid, or potash.

*Cultivation.*—Second ratoon crop harvested 17th September, 1928. Ratooned, after burning off trash, by ploughing four furrows to 12 inches between the cane rows ; land levelled down with tyne harrows.

*Fertiliser application.*—In November 1928, fertilisers were applied as shown on the plan.

*Growth.*—The cane ratooned well in all plots, and made unchecked growth throughout the season. The plots fertilised with nitrogenous manures were always the most advanced and had the healthiest appearance.

**Yields.**

| Plot. | Manurial Treatment. | Juice Analysis. | | | Cane. | | Cane Per Acre. | C.C.S. Per Acre. |
|---|---|---|---|---|---|---|---|---|
| | | Brix. | Polarisation. | Purity. | Polarisation. | % C.C.S. | | |
| | | | | | | | Tons. | Tons. |
| 1 | 500 lb. basic superphosphate | 21·6 | 19·91 | 92·1 | 16·92 | 16·0 | **30·4** | **4·86** |
| 2 | 500 lb. meatworks | 21·6 | 19·98 | 92·5 | 16·98 | 16·1 | **28·1** | **4·53** |
| 3 | 200 lb. basic superphosphate<br>100 lb. sulphate of ammonia<br>200 lb. nitrate of soda | 21·5 | 19·86 | 92·4 | 16·88 | 16·0 | **37·8** | **6·05** |
| 4 | No manure | 22·5 | 20·98 | 93·2 | 17·73 | 17·0 | **20·6** | **3·50** |
| 5 | 500 lb. sulphate of potash | 21·9 | 20·40 | 93·1 | 17·34 | 16.5 | **28·0** | **4·62** |
| 6 | 250 lb. sulphate of ammonia<br>250 lb. nitrate of soda | 21·2 | 19·45 | 91·7 | 16·53 | 15·6 | **34·4** | **5·36** |

**Summary of Crop Yields—Plant, First, Second, and Third Ratoons.**

| Manurial Treatment. | Plant Crop 12 Months. | | First Ratoon Crop— 12 Months. | | Second Ratoon Crop— 11 Months. | | Third Ratoon Crop— 11 Months. | | Average for 4 Crops. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. |
| | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. |
| 500 lb. basic superphosphate | 41·6 | 7·52 | 42·4 | 7·27 | 32·1 | 5·22 | 30·4 | 4·86 | **36·6** | **6·22** |
| 500 lb. meatworks | 42·9 | 7·05 | 43·8 | 7·33 | 31·1 | 5·06 | 28·1 | 4·53 | **36·5** | **5·99** |
| 200 lb. basic superphosphate<br>100 lb. sulphate of ammonia<br>200 lb. nitrate of soda | 39·5 | 6·59 | 46·3 | 7·74 | 38·6 | 6·34 | 37·8 | 6·05 | **40·6** | **6·68** |
| No manure | 42·7 | 7·02 | 35·7 | 5·08 | 24·3 | 4·15 | 20·6 | 3·50 | **30·8** | **4·94** |
| 500 lb. sulphate of potash | 43·5 | 7·42 | 45·0 | 7·72 | 33·5 | 5·69 | 28·0 | 4·62 | **37·5** | **6·36** |
| 250 lb. sulphate of ammonia<br>250 lb. nitrate of soda | 41·2 | 7·06 | 45·3 | 6·69 | 34·2 | 5·62 | 34·4 | 5·36 | **38·8** | **6·18** |

## CONCLUSIONS.

A review of the results for the four crops shows the consistent high yields following the use of the mixture of phosphatic and nitrogenous manures (plot 3). This is in accordance with our previous results for this soil. Yields from phosphates (plot 1), potash (plot 5), and nitrogen (plot 6) alone showed a very marked falling-off after the 1st ratoon crop, due to deficiencies of other plant food not supplied by the single constituents alone.

The yields from the no-treatment plot fell off steadily after the plant crop, and demonstrate the absolute necessity for the consistent use of fertiliser if high yields are to be maintained on soils of this type.

**Work of the Northern Sugar Experiment Station**—*continued.*

## TYPE OF PLANTING MATERIAL (Second Ratoon Crop).

Comparison of Plants cut from Tops, Middles, and Bottoms of Sticks.

| |
|---|
| 1. Bottom plants. |
| 2. Middle plants. |
| 3. Top plants. |

*Variety.*—Badila.
*Harvested.*—September 1929.
*Age of crop.*—12 months.
*Experimental method.*—Single plots of each type.
*Plots.*—0·245 acre.
*Cultivation.*—The first ratoon crop was harvested on the 2nd October, 1928; all plots were ratooned to a depth of 12 inches, and harrowed to level off.

*Fertiliser.*—In November 1928, mixed fertiliser was applied to all plots at the following rate per acre:—

150 lb. sulphate of ammonia;
50 lb. nitrate of soda;
300 lb. meatworks;
100 lb. sulphate of potash.

*Growth.*—The cane ratooned well and the various plots made even growth up to the time of harvesting.

**Yields.**

| Plot No. | Type of Plant. | Juice Analysis. | | | Cane. | | Cane per Acre. | C.C.S. per Acre. |
|---|---|---|---|---|---|---|---|---|
| | | Brix. | Polarisation. | Purity. | Polarisation. | % C.C.S. | | |
| | | | | | | | Tons. | Tons. |
| 1 | Bottom plant .. .. .. .. | 22·0 | 20·42 | 92·8 | 17·36 | 16·5 | **34·4** | **5·68** |
| 2 | Middle plant .. .. .. .. | 21·8 | 20·31 | 93·1 | 17·26 | 16·4 | **33·1** | **5·43** |
| 3 | Top plant .. .. .. .. | 22·2 | 20·76 | 93·5 | 17·65 | 16·9 | **34·1** | **5·76** |

**Summary of Crop Yields—Plant, First and Second Ratoons.**

| Plot No. | Type of Plant. | Plant Crop—13 Months. | | First Ratoon Crop—12 Months. | | Second Ratoon Crop—12 Months. | | Average for Three Crops. | |
|---|---|---|---|---|---|---|---|---|---|
| | | Cane Per Acre. | C.C.S. Per Acre. | Cane Per Acre. | C.C.S. Per Acre. | Cane Per Acre. | C.C.S. Per Acre. | Cane Per Acre. | C.C.S. Per Acre. |
| | | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. |
| 1 | Bottom plant .. .. .. | 43·6 | 7·06 | 38·4 | 6·50 | 34·4 | 5·68 | **38·8** | **6·41** |
| 2 | Middle plant .. .. .. | 38·7 | 6·38 | 37·9 | 6·78 | 33·1 | 5·43 | **36·5** | **6·20** |
| 3 | Top plant .. .. .. | 39·2 | 6·43 | 38·0 | 6·54 | 34·1 | 5·76 | **37·1** | **6·24** |

## CONCLUSIONS.

Very little difference was shown in the crop yields throughout, although there appears to be a slight advantage in favour of bottom plants, in this trial. A determination of the value of any type of planting material is undoubtedly closely related to the time of planting. A certain type of plant would be selected for early planting, and one quite different may be found most suitable for August planting.

**Work of the Northern Sugar Experiment Station**—*continued.*

## SUPERPHOSPHATE TRIAL (Second Ratoon Crop).

| |
|---|
| 1. No manure. |
| 2. 1,000 lb. superphosphate (1 dressing). |
| 3. No manure. |
| 4. 1,000 lb. superphosphate (3 dressings). |
| 5. 1,000 lb. basic superphosphate (1 dressing). |
| 6. No manure. |
| 7. 1,000 lb. basic superphosphate (3 dressings). |

*Variety.*—Badila.

*Harvested.*—September 1929.

*Age of Crop.*—12 months.

*System of Replication.*—Triplicate control plots, 2 replicates of each treatment.

*Plots.*—0·1956 acre.

*Cultivation.*—The first ratoon crop was harvested on the 2nd October, 1928; ratooned to a depth of 12 inches with plough and subsoiler, and harrowed to level off.

*Growth Notes.*—The ratooned cane came away well and made even growth until November, when, after a rainfall of 13 inches, the manured plots showed marked advanced growth. This was maintained until the time of harvesting.

**Yields.**

| Plot No. | Treatment. | Juice Analysis. | | | Cane. | | Cane per Acre. | C.C.S. per Acre. |
|---|---|---|---|---|---|---|---|---|
| | | Brix. | Polarisation. | Purity. | Polarisation. | % C.C.S. | | |
| | | | | | | | Tons. | Tons. |
| 1 | No manure .. .. .. .. | 22·9 | 21·48 | 93·8 | 18·26 | 17·4 | **18·3** | **3·17** |
| 3 | Ditto .. .. .. .. | 22·8 | 21·34 | 93·6 | 18·14 | 17·3 | **19·4** | **3·36** |
| 6 | Ditto .. .. .. .. | 23·0 | 21·60 | 93·9 | 18·36 | 17·5 | **20·3** | **3·56** |
| 2 | 1,000 lb. superphosphate (1 dressing) .. | 22·4 | 20·97 | 93·6 | 17·82 | 17·0 | **22·1** | **3·76** |
| 4 | 1,000 lb. superphosphate (3 dressings) .. | 22·2 | 20·80 | 93·7 | 17·68 | 16·9 | **23·7** | **4·01** |
| 5 | 1,000 lb. basic superphosphate (1 dressing) | 22·5 | 20·72 | 92·0 | 17·61 | 16·6 | **23·2** | **3·86** |
| 7 | 1,000 lb. basic superphosphate (3 dressings) | 22·1 | 20·61 | 93·2 | 17·52 | 16·7 | **24·6** | **4·11** |

Fibre in Cane = 10 per cent.

**Summary of Crop Yields—Plant, First and Second Ratoons.**

| Plot No. | Treatment. | Plant Crop—13 Months. | | First Ratoon Crop—12 Months. | | Second Ratoon Crop—12 Months. | | Average for 3 Crops. | |
|---|---|---|---|---|---|---|---|---|---|
| | | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. |
| | | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. |
| 1 | No manure .. .. .. | 28·3 | 4·85 | 24·1 | 4·14 | 18·3 | 3·17 | **23·6** | **4·05** |
| 3 | Ditto .. .. .. | 26·6 | 4·61 | 24·4 | 4·19 | 19·4 | 3·36 | **23·5** | **4·05** |
| 6 | Ditto .. .. .. | 28·1 | 4·48 | 23·9 | 3·98 | 20·3 | 3·56 | **24·1** | **4·01** |
| 2 | 1,000 lb. superphosphate (1 dressing) | 28·1 | 4·91 | 32·0 | 5·31 | 22·1 | 3·76 | **27·4** | **4·66** |
| 4 | 1,000 lb. superphosphate (3 dressings) | 30·4 | 5·18 | 34·2 | 5·59 | 23·7 | 4·01 | **29·4** | **4·93** |
| 5 | 1,000 lb. basic superphosphate (1 dressing) | 32·5 | 5·60 | 33·8 | 5·51 | 23·2 | 3·86 | **29·8** | **4·99** |
| 7 | 1,000 lb. basic superphosphate (3 dressings) | 28·4 | 4·68 | 35·1 | 5·77 | 24·6 | 4·11 | **29·4** | **4·85** |

## CONCLUSIONS.

This trial was located on a piece of rather poor land, and the results indicate very definite response to phosphate. The increased yields were most marked in the first ratoon crops. The yields for the second ratoon crop are very much reduced, indicating that some other plant-food material which has not been supplied has become a seriously limiting factor. From the results of another experiment report herewith, there is probably a decided lack of nitrogen, and possibly potash, in this soil. However, a definite response is shown to phosphates on the second ratoon crop, and a comparison of the average yields for the three crops shows very clearly the need for phosphatic fertilisers on these soils.

Basic superphosphate showed no marked superiority over the superphosphate, but the results are scarcely comparable as the amounts of phosphoric acid applied are not identical.

In this trial, three dressings gave no significant gain over the same amount of fertiliser applied in one dressing.

**Work of the Northern Sugar Experiment Station**—*continued.*

## CULTIVATION AND MANURIAL EXPERIMENT (First Ratoon Crop).

*Variety.*—Badila.

*Harvested.*—September 1929.

*Age of Crop.*—12 months.

*Experimental Plan.*—Single plots of each cultural treatment, with and without fertiliser.

| |
|---|
| 1. Ordinary cultivation. No manure. |
| 2. Subsoiled to 18 in. No manure. |
| 3. Ordinary cultivation. 650 lb. mixed manure. |
| 4. Subsoiled to 18 in. 650 lb. mixed manure. |

*Plots.*—0·489 acre.

*Cultivation.*—The plant crop was harvested on the 6th October, 1928, and plots 1 and 3 ratooned, in the usual manner, to a depth of 12 inches. Plots 2 and 4 were ratooned with plough and subsoiler to a depth of 18 inches.

*Fertilisation.*—In November, plots 3 and 4 received an application of fertiliser at the following rate per acre :—

150 lb. sulphate of ammonia ;
100 lb. nitrate of soda ;
300 lb. superphosphate ;
100 lb. sulphate of potash.

**Yields.**

| Plot No. | Treatment. | Juice Analysis. | | | Cane. | | Cane per Acre. | C.C.S. per Acre. |
|---|---|---|---|---|---|---|---|---|
| | | Brix. | Polarisation. | Purity. | Polarisation. | % C.C.S. | | |
| | | | | | | | Tons. | Tons. |
| 1 | Ordinary cultivation (no manure) .. | 22·4 | 21·02 | 93·8 | 17·97 | 17·2 | **30·0** | **5·16** |
| 2 | Subsoiled to 18 in. (no manure) .. | 22·4 | 20·84 | 93·0 | 17·82 | 16·9 | **33·1** | **5·60** |
| 3 | Ordinary cultivation (650 lb. mixed manure) | 22·1 | 20·46 | 92·5 | 17·49 | 16·6 | **36·2** | **6·01** |
| 4 | Subsoiled to 18 in. (650 lb. mixed manure) | 21·9 | 20·30 | 92·7 | 17·36 | 16·5 | **41·1** | **6·78** |

**Summary of Crop Yields—Plant and First Ratoon Crops.**

| Plot No. | Treatment. | Plant Crop—13 Months. | | First Ratoon Crop—12 Months. | | Average for Two Crops. | |
|---|---|---|---|---|---|---|---|
| | | Cane Per Acre. | C.C.S. Per Acre. | Cane Per Acre. | C.C.S. Per Acre. | Cane Per Acre. | C.C.S. Per Acre. |
| | | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. |
| 1 | Ordinary cultivation (no manure) .. .. .. | 35·5 | 6·16 | 30·0 | 5·15 | **32·8** | **5·66** |
| 2 | Subsoiled to 18 in. (no manure) .. .. .. | 39·2 | 6·67 | 33·1 | 5·60 | **36·2** | **6·14** |
| 3 | Ordinary cultivation (650 lb. mixed manure) .. | 41·0 | 6·79 | 36·2 | 6·00 | **38·6** | **6·40** |
| 4 | Subsoiled to 18 in. (650 lb. mixed manure) .. | 46·3 | 7·60 | 41·1 | 6·77 | **43·7** | **7·19** |

### REMARKS.

The yields from the first ratoon crop accurately parallel those obtained from the plant. They again confirm the conclusion that it is profitable to subsoil the heavier type of alluvial soil in this area.

Marked response was obtained where fertilisers were applied, and the necessity for thorough cultivation in addition to adequate manuring is demonstrated. For an application of 650 lb. of mixed manure, the following gains were found :—

With ordinary cultivation—3·4 tons cane per acre.

With subsoiling to 18 inches—5·1 tons cane per acre.

This experiment will be carried on to the second ratoon crop.

**Work of the Northern Sugar Experiment Station**—*continued.*

## LIMING EXPERIMENTS (First Ratoon Crop).

*Variety.*—Badila.

*Harvested.*—September 1929.

*Age of Crop.*—12 months.

| | |
|---|---|
| Block I. | 1. Burnt lime, 1 ton. |
| | 2. Burnt lime, 2 tons. |
| | 3. No lime. |
| Block II. | 4. Burnt lime, 1 ton. |
| | 5. Burnt lime, 2 tons. |
| | 6. No lime. |

*System of Replication.*—Duplicate plots of each treatment.

*Plots.*—0·35 acre.

*Land Preparation.*—At the commencement of this experiment the land was prepared by sowing with cowpea; the green crop was ploughed under and allowed to rot. The field was ploughed four times to a depth of 12 inches; the lime was applied after the final ploughing and harrowed in. The plant crop was sown in August 1927, and harvested in September 1928. The various plots were then ratooned in the usual manner, to a depth of 12 inches, and no further applications of lime made. No fertiliser was applied to either plant or ratoon crop.

*Growth.*—The limed plots showed markedly advanced growth throughout the growing period, as will be seen from the results below:—

**Yields.**

| Block. | No Lime. | | | 1 Ton Burnt Lime. | | | 2 Tons Burnt Lime. | | |
|---|---|---|---|---|---|---|---|---|---|
| | Cane per Acre. | % C.C.S. in Cane. | C.C.S. per Acre. | Cane per Acre. | % C.C.S. in Cane. | C.C.S. per Acre. | Cane per Acre. | % C.C.S. in Cane. | C.C.S. per Acre. |
| | Tons. | | Tons. | Tons. | | Tons. | Tons. | | Tons. |
| I. .. .. .. | 30·9 | 17·6 | 5·43 | 34·4 | 17·3 | 5·95 | 38·2 | 17·2 | 6·57 |
| II. .. .. .. | 31·2 | 16·9 | 5·27 | 36·4 | 17·1 | 6·23 | 39·1 | 17·0 | 6·65 |
| Averages .. .. | **31·1** | 17·3 | **5·35** | **35·4** | 17·2 | **6·09** | **38·7** | 17·1 | **6·61** |

**Summary of Crop Yields—Plant and First Ratoon Crops.**

| Treatment. | Plant Crop—13 Months. | | First Ratoon Crop—12 Months. | | Average for Two Crops. | |
|---|---|---|---|---|---|---|
| | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. |
| | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. |
| No lime .. .. .. .. .. | 32·9 | 5·61 | 31·1 | 5·35 | **32·0** | **5·48** |
| 1 ton burnt lime .. .. .. .. | 39·1 | 6·12 | 35·4 | 6·09 | **37·3** | **6·11** |
| 2 tons burnt lime .. .. .. .. | 40·8 | 6·12 | 38·7 | 6·61 | **39·8** | **6·37** |

## DISCUSSION OF RESULTS.

The yields for the first ratoon crop confirm the conclusions drawn from the plant crop yields, that the acid alluvial soils of this area are greatly in need of lime. Further, some idea of the "lasting" effects of the lime can also be gained from the results. Whereas for the plant crop the gains from 1 ton or 2 tons of lime were practically identical, the heavier dressing gave a decided gain over the lighter on the first ratoon crop.

It will be interesting to compare these results with the yields from the second ratoon crop, but it would seem that on soils of this type a lime application of at least 1 ton to the acre of burnt lime is necessary once in every rotation (five years), to maintain the supply of available lime in the soil, and correct the unfavourable conditions attending soil acidity.

A series of soil samples taken from these plots has been tested in the laboratory, and the results correlate very closely with the crop yields. These results will be reported separately.

**Work of the Northern Sugar Experiment Station**—*continued.*

## CORAL LIME (Plant Crop).

*Variety.*—Badila.

*Harvested.*—September 1929.

*Age of Crop.*—12 months.

| | | |
|---|---|---|
| I. | 1 ton coral lime. | No lime. |
| II. | No lime. | 1 ton coral lime. |
| III. | 1 ton coral lime. | No lime. |

*System of Replication.*—Three plots limed, three unlimed.

*Plots.*—·0692 acre.

*Land Preparation.*—A block of land was prepared for this experiment by ploughing four times to a depth of 12 inches. The block was divided into six equal plots, three of which were untreated, and the remaining three received a dressing of coral lime, at the rate of 1 ton per acre.

Cane planted in August 1928.

*Growth.*—The crop made even progress until after March 1929, when the limed plots showed the most advanced growth.

**Yields.**

| Block. | No Lime. | | | 1 Ton Coral Lime. | | |
|---|---|---|---|---|---|---|
| | Cane per Acre. | % C.C.S. in Cane. | C.C.S. per Acre. | Cane per Acre. | % C.C.S. in Cane. | C.C.S. per Acre. |
| | Tons. | | Tons. | Tons. | | Tons. |
| I. .. .. .. .. .. | 37·6 | 16·0 | 6·02 | 39·2 | 16·0 | 6·27 |
| II. .. .. .. .. .. | 36·6 | 16·0 | 5·86 | 38·9 | 15·8 | 6·14 |
| III. .. .. .. .. .. | 39·0 | 16·2 | 6·32 | 40·2 | 16·0 | 6·43 |
| Averages .. .. .. .. | **37·7** | 16·1 | **6·07** | **39·4** | 15·9 | **6·28** |

## DISCUSSION.

The response to the application of coral lime has been small, though significant. A comparison with the response obtained on the burnt lime trials shows that the coral lime is much slower in its action. The ratoon crops will probably show up to better advantage.

**Work of the Northern Sugar Experiment Station**—*continued.*

## SOAKING PLANTS (Plant Crop).

| | |
|---|---|
| Block I. | 1. Plants unsoaked. |
| | 2. Plants soaked in saturated solution of lime water + 1 lb. magnesium sulphate to 50 galls. |
| | 3. Plants soaked in saturated solution of lime water. |
| | 4. Plants soaked in water. |
| | 5. Plants soaked in saturated solution of lime water + 5 lb. nitrate of soda in 50 galls. |
| Block II. | 6. Plants unsoaked. |
| | 7. Plants soaked in saturated solution of lime water + 1 lb. magnesium sulphate to 50 galls. |
| | 8. Plants soaked in saturated solution of lime water. |
| | 9. Plants soaked in water. |
| | 10. Plants soaked in saturated solution of lime water + 5 lb. nitrate of soda in 50 galls. |

*Variety.*—Badila.

*Harvested.*—September 1929.

*Age of Crop.*—13 months.

*System of Replication.*—Duplicate plots of each of five treatments.

*Plots.*—0·119 acre.

*Object.*—To obtain information as to the effect, on germination and yield, of soaking plants for 48 hours in different solutions. The plants for this experiment were carefully selected, and the same numbers used in each plot.

*Preparation of Land.*—The land was prepared according to the usual standard practice.

**Yields.**

| Block. | Unsoaked. | | Lime Water + Mag./Sulph. | | Lime Water. | | Water. | | Lime Water + Nitrate of Soda. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. |
| | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. |
| I. .. .. | 38·0 | 5·73 | 41·0 | 6·35 | 39·4 | 5·94 | 40·0 | 6·10 | 41·2 | 6·28 |
| II. .. .. | 38·3 | 6·00 | 41·7 | 6·41 | 41·0 | 6·44 | 40·8 | 6·20 | 42·5 | 6·69 |
| Averages .. | **38·2** | **5·87** | **41·4** | **6·38** | **40·2** | **6·19** | **40·4** | **6·15** | **41·9** | **6·49** |

## DISCUSSION.

The results confirm experimental results previously obtained both here and elsewhere. For August planting in this area there is no doubt regarding the value of soaking plants as an aid in promoting a rapid and high degree of germination. This effect is reflected in the final yields, which indicate that nitrate of soda and sulphate of magnesium solutions are particularly effective.

**Work of the Northern Sugar Experiment Station**—*continued.*

## VARIETAL TRIAL (Plant Crop).

| I. | II. | III. |
|---|---|---|
| S.J. 4 | S.J. 16 | S.J. 3 |
| S.J. 3 | Badila | S.J. 28 |
| S.J. 28 | S.J. 4 | S.J. 16 |
| S.J. 16 | S.J. 3 | Badila |
| Badila | S.J. 28 | S.J. 4 |

*Harvested.*—September 1929.

*Age of Crop.*—12 months.

*System of Replication.*—Three randomised blocks.

*Plots.*—0·1561 acre.

*Manurial Treatment.*—All plots received fertiliser at the following rate, per acre :—

| | |
|---|---|
| Meatworks .. .. .. | 200 lb. |
| Sulphate of potash .. | 100 lb. |
| Sulphate of ammonia .. | 100 lb. |
| Nitrate of soda .. .. | 100 lb. |

*Preparation of Land.*—Cowpeas planted November 1927. Ploughed under, March 1928. After rotting of organic matter, land ploughed and harrowed four times. Planted September 1928.

**Yields.**

| Block. | Badila. | | | S.J. 3. | | | S.J. 4. | | | S.J. 16. | | | S.J. 28. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cane per Acre. | % C.C.S. in Cane. | C.C.S. per Acre. | Cane per Acre. | % C.C.S. in Cane. | C.C.S. per Acre. | Cane per Acre. | % C.C.S. in Cane. | C.C.S. per Acre. | Cane per Acre. | % C.C.S. in Cane. | C.C.S. per Acre. | Cane per Acre. | % C.C.S. in Cane. | C.C.S. per Acre. |
| | Tons. | | Tons. | Tons. | | Tons. | Tons. | | Tons. | Tons. | | Tons. | Tons. | | Tons. |
| I. .. | 40·6 | 16·0 | 6·50 | 41·3 | 15·0 | 6·20 | 59·2 | 15·6 | 9·23 | 47·4 | 15·6 | 7·39 | 44·5 | 14·8 | 6·58 |
| II. .. | 40·7 | 16·3 | 6·63 | 43·5 | 14·7 | 6·39 | 57·7 | 15·5 | 8·94 | 46·0 | 15·0 | 6·90 | 45·7 | 14·5 | 6·63 |
| III. .. | 39·4 | 16·1 | 6·34 | 42·6 | 14·9 | 6·34 | 59·5 | 15·3 | 9·10 | 45·1 | 15·0 | 6·76 | 43·5 | 14·6 | 6·35 |
| Averages | **40·2** | 16·1 | **6·49** | **42·5** | 14·9 | **6·31** | **58·8** | 15·5 | **9·09** | **46·2** | 15·2 | **7·02** | **44·6** | 14·6 | **6·52** |

## DISCUSSION.

The plant crop results indicate a decided superiority of S.J. 4 over the other varieties and Badila, in tonnage of cane per acre. Badila shows, however, a considerably high c.c.s. content, and for this reason the S.J. 4 cane tonnages must be discounted somewhat. The results from this crop bear out our previous conclusions, that S.J. 4 is a very promising variety, but, due to its lower c.c.s. value as compared with Badila, we would recommend it as a cane for the poorer lands of North Queensland, where Pompey, D, 1135, &c., are at present grown.

This variety is undergoing replicated trials on soils of this type at the present time, on eleven selected farms.

## DISTRIBUTION OF VARIETIES FROM THE SOUTH JOHNSTONE EXPERIMENT STATION.

The annual free distribution of cane was made during the months of August and September, when 340 farmers availed themselves of the opportunity of securing new seedling canes and standard varieties.

The canes most in demand were S.J.Q. 4, Badila, Tableland Badila, Oba Badila, Badila Seedling, E.K. 28, Q. 813, and H.Q. 458. Cane was also supplied for eleven variety trial plots in the districts of Mossman, Cairns, Gordonvale, Babinda, Goondi, South Johnstone, Mourilyan, and Tully.

## ANNUAL FIELD DAY.

The Annual Field Day of the South Johnstone Sugar Experiment Station was held this year on Thursday, 4th July, and was attended by a record gathering of farmers and others interested in the industry.

Proceedings were under the direction of Dr. H. W. Kerr (Acting Director), who delivered an address on Agriculture and a résumé of the work carried out at this station during the past twelve months. Addresses were also delivered by Mr. A. F. Bell (Pathologist), and Mr. J. Buzacott (Assistant Entomologist), who illustrated their speeches by a complete exhibit of diseased canes and insect pests.

At the conclusion of the addresses a field inspection of the various experimental plots, cane varieties, and South Johnstone seedling canes was made.

**Work of the Northern Sugar Experiment Station—*continued.***

Luncheon was provided at midday, after which the gathering witnessed demonstrations of tractors, farming implements, and a horse-drawn fumigator injector.

The thanks of the Bureau are due to Messrs. Robinson Bros., G. Hughes, C. Fleming, Innisfail Motors, B. Spears, J. Killaris, and Darveniza Bros., for the machinery display.

## DETAILED REPORT OF ANALYTICAL WORK PERFORMED AT THE LABORATORY OF THE SUGAR EXPERIMENT STATION AT SOUTH JOHNSTONE, FROM 1st NOVEMBER, 1928, TO 31st OCTOBER, 1929.

| Materials. | Number of Analyses. |
|---|---|
| Sugar-canes for growers | 58 |
| Sugar-canes for South Johnstone Show | 6 |
| Sugar-canes for Experiment Station | 1,352 |
| Sugar-cane fibres | 59 |
| Coral lime | 6 |
| Agricultural lime | 11 |
| Burnt lime | 2 |
| Fertilisers | 8 |
| Waters | 4 |
| Soils | 54 |
| Total | 1,560 |

## SEEDLING PROPAGATION AT THE SOUTH JOHNSTONE SUGAR EXPERIMENT STATION.

The raising of seedling canes was commenced at the South Johnstone Sugar Experiment Station in 1921, and up to the present 39,936 seedlings have been raised. Most of our seedlings have been obtained from the crossing of noble canes (*Saccharum officinarum*), and the first introduction of *Saccharum spontaneum* into our breeding programme was made during the 1928 season.

The crossing of our noble canes has so far resulted in a number of seedlings that yield a considerably higher amount of sugar per acre than our standard canes, but in general are rather disappointing in their degree of resistance to our most important diseases. S.J.Q. 4 is one of our most promising seedlings, and this cane at twelve months produced the high yield of 9 tons of commercial cane sugar per acre. This seedling is at present undergoing further field experimental trials in each Northern mill district.

The following varieties—Kassoer, Glagah, P.O.J. 2364, P.O.J. 2722, P.O.J. 2875, P.O.J. 2940, D.I. 52, S.W. 3, S.W. 499, and Black Cheribon—were introduced from Java in 1928. The varieties are those used chiefly in that country for breeding purposes, and their introduction will strengthen our selection of breeding canes very materially.

The 1929 crossing programme was seriously curtailed on account of the large number of canes that either failed to arrow or to produce viable pollen. The available parents were carefully selected for the transmission of certain desired characteristics, and included both superior and inferior canes. A large number of fresh combinations are made each year with the object of obtaining information relating to the inheritance characteristics of these different crosses.

Artificial crossing was employed exclusively during the past season. Two methods were employed :—

(1) The planting of the selected parents in adjacent rows, so that the desired male arrows may be fixed in a position surrounding the female arrows, without disturbing either growing stick ;

(2) The Hawaiian sulphurous acid method, in which the selected male arrows are cut during the afternoon, between the hours of 4 and 6, the ends cut under water, and then placed in a solution of sulphurous acid (0·03 to 0·05 per cent.). The tassels are then placed alongside the females—two male arrows to each—and fixed by means of poles. The sulphurous acid is changed every second day, and one internode cut from the stick every fourth day. The male tassel is removed after twelve days, and the female covered by a fine cheese-cloth bag and allowed to ripen, after which it is dried for two days, fully exposed to sun and air.

When there is a chance of foreign pollen interfering with a desired cross, the parent arrows are covered by means of a fine muslin bag with wire ring supports and suspended from above.

The sowing of the seed and the subsequent treatment of the young seedlings was fully dealt with in the 1928 Annual Report.

**Work of the Northern Sugar Experiment Station**—*continued.*

The following are particulars of the number of seedlings raised each year from 1921 to 1929 :—

| Year. | Number. | Year. | Number. |
|---|---|---|---|
| 1921 | 736 | 1927 | 15,000 |
| 1922 | 246 | 1928 | 12,045 |
| 1923 | 344 | 1929 | 5,100 |
| 1924 | 3,005 | | |
| 1925 | 460 | Total | 39,936 |
| 1926 | 3,000 | | |

## YIELD OF CANE HARVESTED FROM THE SUGAR EXPERIMENT STATION AT SOUTH JOHNSTONE, SEASON 1929.

| | Tons. |
|---|---|
| Cane sent to mill | 618·5 |
| Used for plants | 26·25 |
| Distributed to farmers and used for analyses | 15·5 |
| Total | 660·25 |

| *Nature of Crop*— | Per cent. |
|---|---|
| Plant cane | 32·91 |
| First ratoon | 49·85 |
| Second ratoon | 7·82 |
| Third ratoon | 9·42 |

| *Tonnages*— | Tons. | Tons per Acre. |
|---|---|---|
| Badila plant | 127·286 | 45·4 |
| Badila first ratoon | 173·28 | 34·4 |
| Badila second ratoon | 51·6425 | 24·1 |
| Badila third ratoon | 62·2 | 28·1 |
| Variety first ratoon | 110·3665 | 39·4 |
| S.J.Q. seedling plant | 89·975 | 48·0 |
| S.J.Q. seedling first ratoon | 45·5 | 43·5 |
| Acreage under cane | | 17·925 |
| Tons of cane per acre | | 36·83 |

## CENTRAL SUGAR EXPERIMENT STATION, MACKAY.

Mr. F. Keogh, Chemist in Charge.

### METEOROLOGICAL.

The conditions for early planting in 1928 were not favourable. February and March were very wet months, and there were eleven wet days in April, so that it was not possible to have land prepared for planting before the winter months. Conditions in May, June, and July were favourable, but cane planted later did not germinate so well, on the average, as that during these three months. Later planted canes suffered from a deficiency of soil moisture, as no rain fell from 6th June until the 5th November. Ratoons suffered also during this dry period.

Due to the backward nature of the crop, and the continued wet weather during December and January, the grass and weeds made great headway, and were difficult to cope with. Where the cane could be kept clean, it made good progress until the heavy rains of April set the soil hard, and these were followed by cool weather.

Owing to the compacted nature of the soil, the moisture was lost rapidly, and the crops appeared to suffer from a lack of water, until good soaking rains in June improved conditions. The succeeding months remained dry and cold, and the cane made very little progress.

The past season has been, then, an unfavourable one for cane growth in the Mackay area.

Rainfall since 1900 at the Sugar Experiment Station, Mackay.

| Year. | Rainfall in Inches. | Year. | Rainfall in Inches. |
|---|---|---|---|
| 1900 | 45·26 | 1915 | 36·27 |
| 1901 | 63·45 | 1916 | 82·93 |
| 1902 | 33·93 | 1917 | 67·92 |
| 1903 | 64·93 | 1918 | 113·97 |
| 1904 | 60·48 | 1919 | 38·03 |
| 1905 | 69·50 | 1920 | 57·27 |
| 1906 | 99·84 | 1921 | 95·89 |
| 1907 | 51·78 | 1922 | 34·47 |
| 1908 | 78·88 | 1923 | 25·23 |
| 1909 | 63·98 | 1924 | 53·37 |
| 1910 | 101·87 | 1925 | 54·80 |
| 1911 | 65·35 | 1926 | 34·69 |
| 1912 | 42·07 | 1927 | 83·87 |
| 1913 | 85·16 | 1928 | 78·28 |
| 1914 | 71·71 | 1929 (10 months) | 60·40 |

**Abstract of Meteorological Observations, made at Sugar Experiment Station, Mackay, from 1st September, 1928, to 31st August, 1929—Covering Growth of Experimental Cane Crops.**

| Month. | Rainfall in Inches. | Number of Wet Days. | Average Rainfall, 28 Years, 1901–1928. | Highest Shade Maximum. | Lowest Shade Maximum. | Mean Shade Maximum. | Highest Shade Minimum. | Lowest Shade Minimum. | Mean Shade Minimum. | Lowest Terrestrial Min. | Mean Terrestrial Min. | Mean Diurnal Range. | Mean Temperature, 9 a.m. | Mean Relative Humidity of the Air. Saturation equalling 100 at 9 a.m. | Mean Daily Evaporation in Inches. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sept. 1928 | ·00 | 0 | 1·96 | 100·9 | 79·8 | 85·8 | 66·2 | 47·1 | 56·4 | 46·0 | 54·4 | 29·4 | 75·1 | 63·0 | ·31 |
| Oct. 1928 | ·01 | 1 | 1·82 | 97·0 | 82·9 | 90·1 | 73·2 | 54·1 | 64·6 | 52·9 | 63·4 | 25·5 | 83·7 | 57·6 | ·39 |
| Nov. 1928 | 6·87 | 11 | 3·0 | 94·9 | 77·1 | 87·9 | 71·7 | 60·9 | 66·9 | 59·8 | 66·2 | 21·0 | 81·2 | 69·7 | ·32 |
| Dec. 1928 | 8·65 | 16 | 8·37 | 93·2 | 75·3 | 87·2 | 75·9 | 64·4 | 69·7 | 64·1 | 69·0 | 17·5 | 81·8 | 81·8 | ·23 |
| Jan. 1929 | 16·33 | 14 | 15·18 | 96·8 | 76·6 | 87·4 | 77·2 | 66·5 | 72·1 | 65·9 | 71·4 | 15·3 | 81·3 | 82·8 | ·22 |
| Feb. 1929 | 12·77 | 12 | 9·64 | 95·1 | 77·5 | 89·7 | 76·2 | 68·0 | 72·1 | 66·0 | 71·3 | 17·6 | 81·9 | 84·2 | ·15 |
| Mar. 1929 | 12·17 | 16 | 10·59 | 101·2 | 78·0 | 87·4 | 76·8 | 61·2 | 70·9 | 58·3 | 68·8 | 16·5 | 79·4 | 82·0 | ·22 |
| Apr. 1929 | 15·45 | 5 | 5·59 | 90·4 | 76·5 | 83·0 | 73·8 | 42·5 | 60·6 | 40·1 | 58·5 | 19·4 | 73·4 | 72·0 | ·30 |
| May 1929 | ·35 | 5 | 3·21 | 86·7 | 74·0 | 79·5 | 61·1 | 40·6 | 53·1 | 36·9 | 49·4 | 26·4 | 68·5 | 74·0 | ·27 |
| June 1929 | 2·54 | 5 | 2·57 | 84·5 | 61·1 | 73·1 | 57·9 | 37·8 | 50·9 | 35·0 | 47·6 | 22·2 | 64·3 | 77·0 | ·25 |
| July 1929 | ·16 | 2 | 1·41 | 79·1 | 68·2 | 74·2 | 59·0 | 34·5 | 46·2 | 29·0 | 41·7 | 28·0 | 63·0 | 69·5 | ·29 |
| Aug. 1929 | ·24 | 2 | 1·06 | 88·1 | 71·4 | 78·2 | 61·7 | 40·0 | 52·0 | 34·1 | 46·9 | 26·2 | 68·3 | 71·5 | ·27 |
| | 75·54 | 89 | 64·40 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | *73·7 | .. |

* Average.

### Experiments dealt with in this Section.

1. Continuation of competitive trial with five South Johnstone Queensland Seedlings—First ratoon crop.
2. Competitive trials of new varieties against Q. 813 and Badila—Plant crop.
3. Crop results in soaking cane sets in different solutions. P.O.J. 2714—Plant crop.

**Work of the Central Sugar Experiment Station**—*continued.*

## VARIETAL TRIAL (First Ratoon Crop).

| |
|---|
| 1. S.J. 2. |
| 2. S.J. 4. |
| 3. S.J. 5. |
| 4. S.J. 15. |
| 5. S.J. 16. |

*Harvested.*—September 1929.

*Age of Crop.*—11½ months.

*Experimental Method.*—Single plots of each variety.

*Plots.*—0·183 acre.

*Cultivation.*—After harvesting the plant crop, the plots were ratooned towards the end of September.

*Fertiliser.*—In October, all plots received mixed fertiliser at the following rate per acre :—

| | Lb. |
|---|---|
| Sulphate of ammonia .. .. | 100 |
| Nitrate of soda .. .. .. | 200 |
| Meatworks .. .. .. .. | 200 |
| Sulphate of potash .. .. | 75 |
| | 575 |

*Growth.*—The canes all ratooned well, and maintained uniform growth. At harvesting, S.J. 4 showed a fair percentage of dead sticks, and some were affected with red rot disease. All other varieties were free from disease, but S.J. 5 showed a pale variegated foliage, and arrowed freely.

**Yields.**

| Variety. | Juice Analysis. | | | Cane. | | Cane per Acre. | C.C.S. per Acre. |
|---|---|---|---|---|---|---|---|
| | Brix. | Polarisation. | Purity. | Polarisation. | % C.C.S. | | |
| | | | | | | Tons. | Tons. |
| S.J. 2 .. .. .. | 24·8 | 23·54 | 94·9 | 19·89 | 19·1 | **31·2** | **5·96** |
| S.J. 4 .. .. .. | 23·7 | 22·10 | 93·2 | 18·12 | 17·2 | **34·0** | **5·85** |
| S.J. 5 .. .. .. | 19·9 | 18·14 | 91·2 | 15·23 | 14·2 | **30·3** | **4·30** |
| S.J. 15 .. .. .. | 24·0 | 22·46 | 93·6 | 18·30 | 17·4 | **28·8** | **5·01** |
| S.J. 16 .. .. .. | 22·5 | 21·92 | 97·4 | 18·08 | 17·6 | **26·7** | **4·70** |

**Summary of Crop Yields—Plant and First Ratoon Crops.**

| Variety. | Plant Crop—14 Months. | | First Ratoon Crop—11½ Months. | | Average of Two Crops. | |
|---|---|---|---|---|---|---|
| | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. |
| | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. |
| S.J. 2 .. .. .. .. .. | 29·2 | 5·45 | 31·2 | 5·96 | **30·2** | **5·71** |
| S.J. 4 .. .. .. .. .. | 31·1 | 5·23 | 34·0 | 5·85 | **32·6** | **5·54** |
| S.J. 5 .. .. .. .. .. | 26·6 | 3·46 | 30·3 | 4·30 | **28·5** | **3·88** |
| S.J. 15 .. .. .. .. .. | 29·5 | 5·09 | 28·8 | 5·01 | **29·2** | **5·05** |
| S.J. 16 .. .. .. .. .. | 28·1 | 4·88 | 26·7 | 4·70 | **27·4** | **4·79** |

## DISCUSSION OF RESULTS.

On the above results, S.J. 2 appears to be the best variety on this type of soil in the Mackay area. It is characterised by a moderately high tonnage in both plant and ratoon crops, and has been notably rich in sugar. S.J. 4, which shows good promise in North Queensland, seems to suffer here under the dry weather conditions.

**Work of the Central Sugar Experiment Station—*continued.***

## VARIETAL TRIAL (Plant Crop).

| |
|---|
| 1. Oba Badila. |
| 2. S.J. 4. |
| 3. Badila. |
| 4. S.J. 28. |
| 5. P.O.J. 2714. |
| 6. Q. 813. |

*Harvested.*—October 1929.

*Age of Crop.*—14 months.

*Experimental Method.*—Single plots of each variety.

*Plots.*—0·13 acre.

*Cultivation.*—The varieties were planted in August 1928. Q. 813 germinated well, but the other canes were patchy in striking. P.O.J. 2714 came away next, and the poorest striker was S.J. 28. Continuous dry weather obtained until November.

*Fertilisation.*—All plots were fertilised uniformly with the following mixture :—

| | Lb. |
|---|---|
| Sulphate of ammonia .. .. | 150 |
| Nitrate of soda .. .. .. | 100 |
| Meatworks .. .. .. | 150 |
| Sulphate of potash .. .. | 75 |
| | 475 |

**Yields.**

| Variety. | Juice Analysis. | | | Cane. | | Cane per Acre. | C.C.S. per Acre. |
|---|---|---|---|---|---|---|---|
| | Brix. | Polarisation. | Purity. | Polarisation. | % C.C.S. | | |
| | | | | | | Tons. | Tons. |
| Oba Badila .. .. .. | 24·1 | 22·71 | 94·2 | 19·30 | 18·5 | **18·9** | **3·49** |
| S.J. 4 .. .. .. .. | 22·6 | 18·43 | 81·5 | 15·29 | 13·3 | **28·1** | **3·74** |
| Badila .. .. .. .. | 23·7 | 22·78 | 96·1 | 19·58 | 19·0 | **20·2** | **3·84** |
| S.J. 28 .. .. .. | 22·5 | 20·98 | 93·2 | 17·83 | 17·0 | **24·2** | **4·11** |
| P.O.J. 2714 .. .. .. | 25·4 | 23·94 | 94·2 | 19·27 | 18·4 | **29·0** | **5·34** |
| Q. 813 .. .. .. | 23·4 | 22·36 | 95·5 | 18·44 | 17·7 | **29·7** | **5·25** |

## DISCUSSION OF RESULTS.

P.O.J. 2714 and Q. 813 gave the highest return of sugar per acre. S.J. 4 was badly infected with red rot disease, which accounts for the low sugar content in October; a large number of dead sticks were discarded. P.O.J. 2714 was also slightly infected with the disease.

The plots will now be ratooned.

**Work of the Central Sugar Experiment Station**—*continued.*

## SOAKING OF PLANTS.

| | |
|---|---|
| Block I. | 1. Not soaked. |
| | 2. Soaked in water. |
| | 3. Soaked in saturated solution of lime water. |
| | 4. Soaked in saturated solution of lime water + 1 lb. sulphate of magnesia in 50 galls. |
| | 5. Soaked in Asahi Promoloid. |
| Block II. | 1. Not soaked. |
| | 2. Soaked in water. |
| | 3. Soaked in saturated solution of lime water. |
| | 4. Soaked in saturated solution of lime water + 1 lb. sulphate of magnesia in 50 galls. |
| | 5. Soaked in Asahi Promoloid. |

*Variety.*—P.O.J. 2714.

*Harvested.*—August 1929.

*Age of Crop.*—12 months.

*System of Replication.*—Duplicate plots of each treatment.

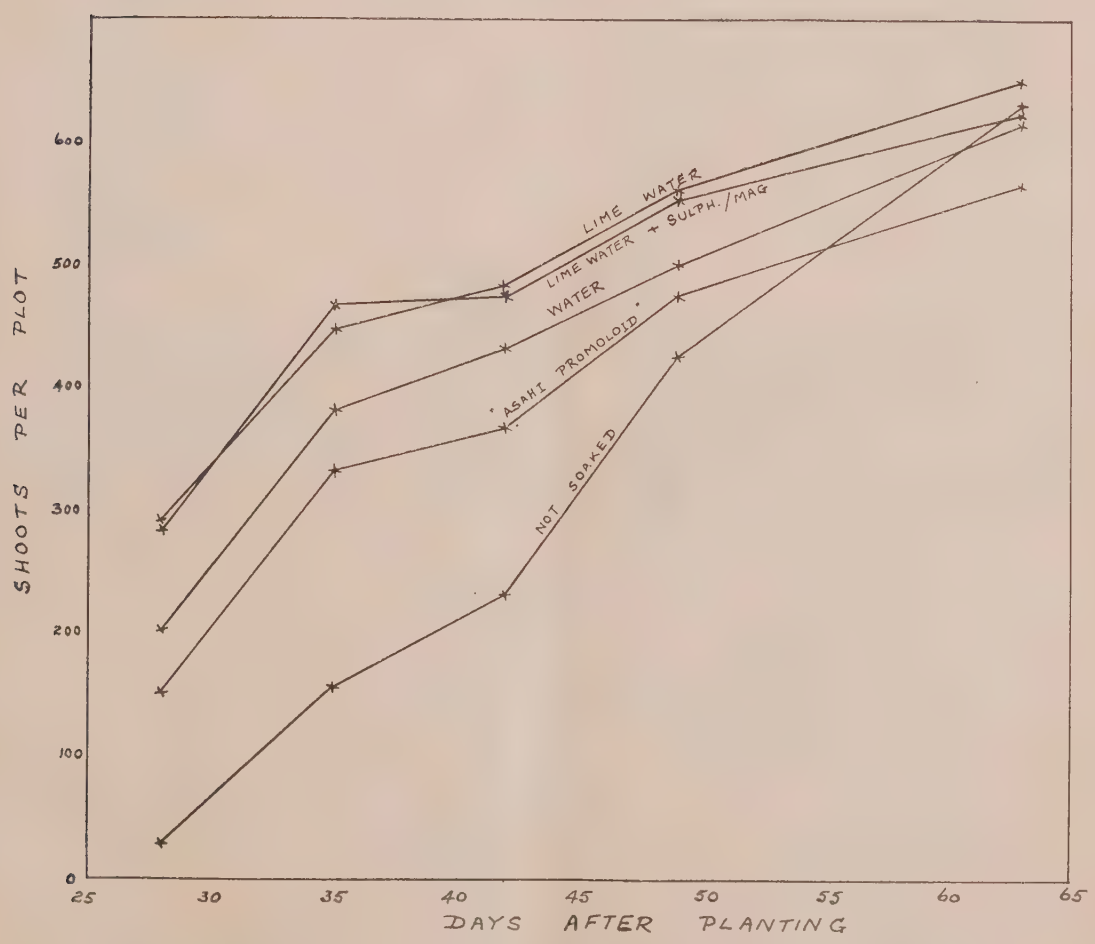
*Plots.*—0·128 acre.

*Object of Experiment.*—To test the value of soaking sets in water and various solutions for 24 hours before planting.

*Cultivation.*—Following the ploughing in and rotting down of a green manure crop, the land was ploughed and harrowed down to a good tilth.

*No fertiliser* was applied in this experiment.

*Germination.*—Where the plants were soaked, germination was accelerated. Progressive counts were made of the shoots which appeared. The results of these counts are brought out in the graph.




After germination no difference in the rate of growth was noted.

**Work of the Central Sugar Experiment Station**—*continued.*

Yields.

| Block. | Not Soaked. | Water. | Lime Water. | Lime Water and Sulphate of Magnesia. | Asahi Promoloid. |
|---|---|---|---|---|---|
| | Cane per Acre—(Tons). | | | | |
| I. .. .. .. .. | 35·5 | 35·1 | 33·8 | 34·4 | 32·4 |
| II. .. .. .. .. | 30·7 | 31·2 | 33·0 | 33·2 | 32·0 |
| Averages .. .. | **33·1** | **33·2** | **33·4** | **33·8** | **32·2** |

## DISCUSSION OF RESULTS.

At harvesting, the crops appeared quite uniform, and this is borne out by the yields. Undoubtedly, the soaking of the sets before planting had a very beneficial effect on the germination, though the final yields do not reflect this advantage.

## DISTRIBUTION OF CANE VARIETIES.

P.O.J. 2714 was the only variety available for distribution this year, and about 40 tons of plants of this cane were sold to farmers.

## DETAILED REPORT OF ANALYTICAL WORK PERFORMED AT THE LABORATORY OF THE SUGAR EXPERIMENT STATION, MACKAY, FROM 1st NOVEMBER, 1928, TO 31st OCTOBER, 1929.

| Materials. | Number of Analyses. |
|---|---|
| Sugar-canes for growers .. .. .. .. .. .. .. | 113 |
| Sugar-canes for station .. .. .. .. .. .. .. | 175 |
| Sugar-canes for Mackay Show .. .. .. .. .. .. | 66 |
| Sugar-canes for Gin Gin Show .. .. .. .. .. .. | 69 |
| Sugar-cane fibre .. .. .. .. .. .. .. .. | 16 |
| Milk samples .. .. .. .. .. .. .. .. .. | 12 |
| Waters .. .. .. .. .. .. .. .. .. | 3 |
| Total .. .. .. .. .. .. .. .. .. | 454 |

## ANNUAL FIELD DAY.

Field Day at the Mackay Station was held on 21st June, with a record attendance of farmers and others interested in the sugar industry. Proceedings were opened by an address by the Acting Director (Dr. H. W. Kerr) on the revised agricultural policy of the Bureau, and interesting addresses were delivered by Messrs. Burns and Wood on pest and disease control. After luncheon, demonstrations of farm implements were much appreciated by the farmers, a novel feature of the proceedings being a creditable performance on a crop of Clark's Seedlings by the Miller-Owen cane harvester.

## YIELD OF CANE FROM THE SUGAR EXPERIMENT STATION, MACKAY, SEASON 1929.

| | Tons. |
|---|---|
| Cane sent to mill .. .. .. .. .. .. .. | 221·075 |
| Sold to farmers .. .. .. .. .. .. .. | 40·0 |
| Used in variety trials .. .. .. .. .. .. | 6·0 |
| Used for plants, Station .. .. .. .. .. .. | 5·0 |
| | 272·075 |

| *Nature of Crop*— | Acres. | Per Cent. |
|---|---|---|
| Plant crop .. .. .. .. | 2·71 .. | 24·1 |
| First ratoons .. .. .. .. | 8·51 .. | 75·9 |

| *Tonnages*— | Tons. | Tons per acre. |
|---|---|---|
| Plant crop .. .. .. .. | 72·0 .. | 26·6 |
| First ratoons .. .. .. .. | 200·075 .. | 23·5 |

| | |
|---|---|
| Acreage under cane .. .. .. .. .. .. | 11·22 |
| Average tons per acre .. .. .. .. .. | 24·24 |

## SOUTHERN SUGAR EXPERIMENT STATION.

Mr. J. Pringle, Chemist in Charge.

### METEOROLOGICAL.

From a cane-growing standpoint, the past season from August 1928 to March 1929 was for the most part adverse, since, following on a fairly cold winter, the three months August to October were dry, only 77 points being recorded. Though there was a good supply of moisture in August from falls of about 6 inches during the previous two months, the soil was cold, so that the autumn plant and young ratoons made but little growth. The cane planted during that month did not germinate till well on towards the end of September, when the shoots were weakly and germination patchy. During September and October, owing to the hot, dry conditions, very little progress was made. At the beginning of November there was a fall of 157 points which produced good growth, but this was retarded by hot, dry weather up till the end of the first week in December, when more favourable conditions prevailed and the cane again commenced to make rapid progress, which was maintained through the following two months, but was again checked by dry weather in March. As cold conditions set in early in April, but little further growth was made up to time of harvesting. The effect of the adverse weather during the growth period is revealed in the light tonnages recorded in the crop result tables.

The past winter was the most severe since the institution of this station, and the successive sharp frosts did much damage to the cane, affecting both the tonnages and quality.

Rainfall at the Southern Sugar Experiment Station, Bundaberg, during the Growing Season.

| Month. | Rainfall. Inches. | Number of Wet Days. |
|---|---|---|
| August 1928 | ·09 | 2 |
| September 1928 | ·12 | 1 |
| October 1928 | ·56 | 2 |
| November 1928 | 1·73 | 7 |
| December 1928 | 3·43 | 6 |
| January 1929 | 4·89 | 12 |
| February 1929 | 8·87 | 15 |
| March 1929 | 1·86 | 6 |
| April 1929 | 5·53 | 8 |
| May 1929 | ·09 | 1 |
| June 1929 | 3·01 | 6 |
| July 1929 | ·12 | 1 |
| August 1929 | ·40 | 2 |
| September 1929 | ·17 | 3 |
| October 1929 | 2·82 | 9 |
| Total | 33·69 | 81 |

**Experiments Dealt with in this Section of the Report.**

1. Conclusion of potash experiment; first ratoons.
2. Fertilising experiment; plant crop.
3. Planting experiment; plant crop.
4. Plant soaking experiment; plant crop.

**Work of the Southern Sugar Experiment Station**—*continued.*

## POTASH EXPERIMENT (First Ratoon Crop).

MURIATE v. SULPHATE.

| | |
|---|---|
| Block I. | 1. 300 lb. sulphate of potash. |
| | 2. 300 lb. muriate of potash. |
| | 3. 500 lb. sulphate of potash. |
| | 4. 500 lb. muriate of potash. |
| | 5. No manure. |
| Block II. | 1. 300 lb. sulphate of potash. |
| | 2. 300 lb. muriate of potash. |
| | 3. 500 lb. sulphate of potash. |
| | 4. 500 lb. muriate of potash. |
| | 5. No manure. |

*Variety.*—Q. 813.

*Harvested.*—September 1929.

*Age of Crop.*—12 months.

*System of Replication.*—Duplicate plots of each treatment.

*Plots.*—0·131 acre.

*Object.*—This experiment was designed to test the relative values of the muriate and sulphate as sources of potash for cane.

*Cultivation.*—After harvesting the plant crop, the plots were ratooned by the usual method of ploughing three furrows between the rows and levelling down with the small harrows. The soil was somewhat dry at this time, and turned up lumpy. Due to dry weather, the cane did not come away until after rain fell in November.

*Fertiliser.*—Applied early in December.

*Growth.*—The manured plots showed in advance of the unmanured plots within a month, and a good stand of cane resulted. There was no apparent difference between the sulphate and muriate plots.

All plots were damaged by frost; this was particularly the case with the shorter canes of the check plots.

**Yields.**

| Block. | 300 lb. Sulphate of Potash. | | 300 lb. Muriate of Potash. | | 500 lb. Sulphate of Potash. | | 500 lb. Muriate of Potash. | | No Manure. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. |
| | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. |
| I. .. .. | 14·4 | 2·32 | 13·0 | 2·13 | 15·1 | 2·44 | 14·2 | 2·16 | 6·8 | 0·88 |
| II. .. .. | 13·4 | 2·06 | 15·1 | 2·33 | 16·0 | 2·35 | 16·0 | 2·39 | 6·2 | 0·84 |
| Averages .. | **13·9** | **2·19** | **14·1** | **2·23** | **15·6** | **2·40** | **15·1** | **2·28** | **6·5** | **0·86** |

**Summary of Crop Yields—Plant and First Ratoon Crops.**

| Treatment. | Plant Crop. | | First Ratoon Crop. | | Average—Two Crops. | |
|---|---|---|---|---|---|---|
| | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. |
| | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. |
| 300 lb. sulphate of potash .. .. | 14·6 | 2·59 | 13·9 | 2·19 | **14·3** | **2·39** |
| 300 lb. muriate of potash .. .. | 16·4 | 2·83 | 14·1 | 2·23 | **15·3** | **2·53** |
| 500 lb. sulphate of potash .. .. | 17·0 | 2·85 | 15·6 | 2·40 | **16·3** | **2·63** |
| 500 lb. muriate of potash .. .. | 18·5 | 3·05 | 15·1 | 2.28 | **16·8** | **2·67** |
| No manure .. .. | 15·5 | 2·60 | 6·5 | 0·86 | **11·0** | **1·73** |

## CONCLUSION.

Unfortunately, the results for the first ratoon crop are seriously affected by the frosts which were experienced during the winter. However, the response to potash is undoubtedly significant, the muriate and sulphate being of equal value in this regard.

**Work of the Southern Sugar Experiment Station**—*continued.*

## FERTILISING TRIAL (Plant Crop).

| | |
|---|---|
| Block I. | 1. 200 lb. sulphate of ammonia.<br>200 lb. superphosphate. |
| | 2. 200 lb. sulphate of ammonia.<br>200 lb. sulphate of potash. |
| | 3. 200 lb. sulphate of ammonia.<br>200 lb. superphosphate.<br>200 lb. sulphate of potash. |
| | 4. No manure. |
| Block II. | 5. 200 lb. sulphate of ammonia.<br>200 lb. superphosphate. |
| | 6. 200 lb. sulphate of ammonia.<br>200 lb. sulphate of potash. |
| | 7. 200 lb. sulphate of ammonia.<br>200 lb. superphosphate.<br>200 lb. sulphate of potash. |
| | 8. No manure. |

*Variety.*—Q. 813.

*Harvested.*—September 1929.

*Age of Crop.*—12 months.

*System of Replication.*—Duplicate plots of each treatment.

*Plots.*—0·182 acre.

*Cultivation.*—Cowpea sown in October 1927, and a fair crop of green matter was ploughed in about the middle of January 1928. Ploughed and harrowed twice and planted in August. The soil was then cold, but after six weeks a good germination resulted.

*Fertiliser.*—Applied in the middle of November.

*Growth.*—There was no apparent difference in growth between any of the plots until February 1929, when plot 2 showed out in advance of the others. These plots escaped frost damage.

**Yields.**

| Block. | 200 lb. Sulph. Ammonia. 200 lb. Superphosphate. | | 200 lb. Sulph. Ammonia. 200 lb. Sulph. Potash. | | 200 lb. Sulph. Ammonia. 200 lb. Superphosphate. 200 lb. Sulph. Potash. | | No Manure. | |
|---|---|---|---|---|---|---|---|---|
| | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. |
| | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. |
| I. .. .. .. | 14·0 | 2·09 | 15·3 | 2·11 | 14·8 | 2·04 | 11·2 | 1·48 |
| II. .. .. | 11·8 | 1·68 | 13·0 | 1·76 | 13·0 | 1·80 | 12·5 | 1·73 |
| Averages .. | **12·9** | **1·89** | **14·2** | **1·94** | **13·9** | **1·92** | **11·9** | **1·61** |

## DISCUSSION.

The increase in yield due to fertiliser is not marked with any particular treatment. The ploughing in of a leguminous crop prior to planting, and the unfavourable growing conditions of the past season, are probably influencing the results, and greater response is to be expected on the ratoon crops.

**Work of the Southern Sugar Experiment Station**—*continued.*

## PLANTING EXPERIMENT (Plant Crop).

MARCH v. AUGUST PLANT.

*Variety.*—Q. 813.

*Harvested.*—October 1929.

*Age of Crop*—

(*a*) March plant, 18 months.

(*b*) August plant, 14 months.

The object of this trial was to determine the influence of early and late planting on the crop yields.

| |
|---|
| 1. Planted—March 1928. |
| 2. Planted—August 1928. |

*Experimental Plan.*—Single plots of each treatment.

*Plots.*—0·96 acre.

*Cultivation.*—Land planted with cowpea in December 1926, after ploughing out stools of previous crop.

A good green crop resulted, and this was ploughed under in February 1927. Ploughed and harrowed again in March and November, and a further ploughing in March 1928; plot 1 was planted in March and a fairly good germination was obtained. Plot 2 was planted in early August 1928, after a harrowing. The cane struck poorly and slowly, and misses were supplied in November.

*Fertiliser.*—*Plot* 1.—Fertilised in August 1928 with the following mixture:—

200 lb. sulphate of ammonia;

100 lb. meatworks;

200 lb. sulphate of potash.

*Plot* 2.—Fertilised in November 1928 with the same mixture as for plot 1.

*Growth.*—Both plots made good growth while the weather was favourable, the March plant maintaining the lead; both plots were affected by frost during the winter of 1929, but the autumn plant being taller was not so badly damaged as the spring plant.

**Results.**

| Plot. | Treatment. | Juice Analysis. | | | Cane. | | Cane per Acre. | C.C.S. per Acre. |
|---|---|---|---|---|---|---|---|---|
| | | Brix. | Polarisation. | Purity. | Polarisation. | % C.C.S. | | |
| | | | | | | | Tons. | Tons. |
| 1 | March plant (18 months crop) | 21·6 | 20·60 | 95·3 | 17·05 | 16·5 | 20·7 | 3·41 |
| 2 | August plant (14 months crop) | 22·4 | 21·41 | 95·5 | 17·71 | 17·1 | 13·3 | 2·27 |

## DISCUSSION OF RESULTS.

The early planted cane made considerably increased growth over the late plant, and, except where the crop is liable to be cut back by winter frosts, would seem to be a very profitable practice, where possible. In general, the land would be lying fallow until the spring; and after ploughing in a green manure crop, autumn plant would be expected to ensure making the best use of the available nitrogen returned to the soil in this way, whereas a delay until the spring might result in considerable loss due to leaching.

**Work of the Southern Sugar Experiment Station**—*continued.*

## PLANT SOAKING EXPERIMENT (Plant Crop).

| | |
|---|---|
| Block I. | 1. Soaked in water. |
| | 2. Soaked in solution of lime water. |
| | 3 Soaked in solution of lime water + 1 lb. sulphate of magnesia to 50 galls. |
| | 4. Soaked in solution of lime water + 5 lb. nitrate of soda to 50 galls. |
| | 5. Unsoaked. |
| Block II. | 1. Soaked in water. |
| | 2. Soaked in solution of lime water. |
| | 3. Soaked in solution of lime water + 1 lb. sulphate of magnesia to 50 galls. |
| | 4. Soaked in solution of lime water + 5 lb. nitrate of soda to 50 galls. |
| | 5. Unsoaked. |

*Variety.*—Q. 813.

*Harvested.*—September 1929.

*Age of Crop.*—12 months.

*System of Replication.*—Duplicate plots of each treatment.

*Plots.*—0·092 acre.

*Object.*—To determine the influence on germination and yield, of soaking plants in water and various solutions for 24 hours, before planting.

*Cultivation.*—Cowpeas planted in November 1927, but crop was practically destroyed by bean-borer in December. Two shallow and one deep ploughings were given, and the cane planted towards the end of August 1928.

*Germinations.*—Plots 3 in each block showed up first, and the shoots were through after a fortnight; these were followed closely by all other plots where the sets had been soaked. The untreated plots came away during the fourth week. One month after planting, a count of the shoots was made, with the following results :—

| Block. | Shoots per Plot. | | |
|---|---|---|---|
| | I. | II. | Average. |
| Plot 1 .. .. | 97 | 143 | **120** |
| Plot 2 .. .. | 169 | 198 | **184** |
| Plot 3 .. .. | 174 | 211 | **193** |
| Plot 4 .. .. | 148 | 175 | **162** |
| Plot 5 .. .. | 21 | 44 | **33** |

It was intended to make a further count later on, but, as the result of a fall of about half an inch of rain in October, all plots germinated well, so that a count was not made.

*Fertiliser.*—No fertiliser was applied in this experiment.

*Growth.*—The plots were all damaged by frosts during the past winter, which accounts somewhat for the very erratic results.

**Yields.**

| Block. | Soaked in Water. | | Soaked in Solution of Lime Water. | | Soaked in Solution of Lime Water + 1 lb. Sulph./Mag. to 50 Gallons. | | Soaked in Solution of Lime Water + 5 lb. Nitrate/Soda to 50 Gallons. | | Unsoaked. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. | Cane per Acre. | C.C.S. per Acre. |
| | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. | Tons. |
| I. .. .. | 8·0 | 1·21 | 9·2 | 1·26 | 11·1 | 1·71 | 8·0 | 1·33 | 9·1 | 1·30 |
| II. .. .. | 11·7 | 1·79 | 12·1 | 1·73 | 12·5 | 1·58 | 12·7 | 1·73 | 15·8 | 2·19 |
| Averages .. | **9·9** | **1·50** | **10·7** | **1·50** | **11·8** | **1·65** | **10·4** | **1·53** | **12·5** | **1·75** |

## DISCUSSION.

The beneficial effect of soaking cane sets before planting was demonstrated by the germination counts, and the value of the treatment, particularly in drought periods, must be recognised. The early advantages of the treatment are not reflected by the final yields, but these are quite unreliable, due to the adverse climatic conditions. The discrepancies between duplicate plots of the same treatment are extremely wide.

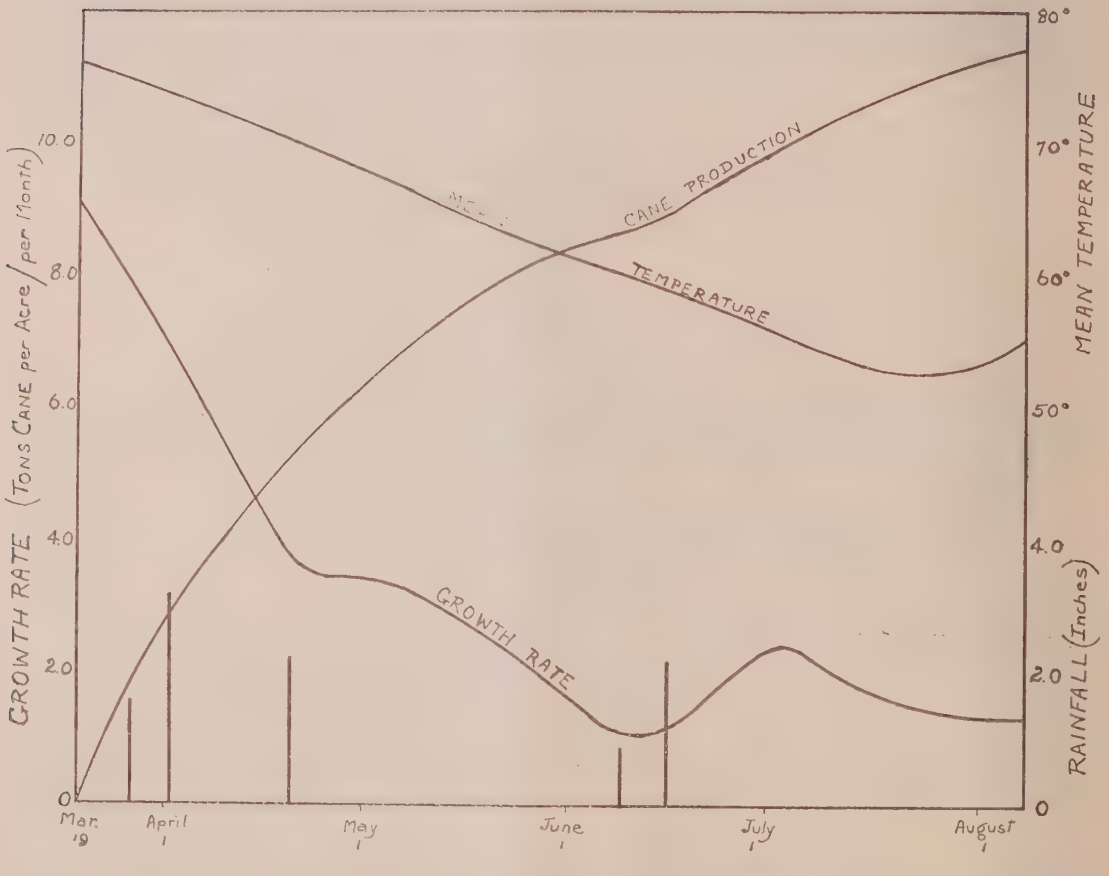
**Work of the Southern Sugar Experiment Station**—*continued.*

## CANE GROWTH MEASUREMENTS.

A series of growth measurements was initiated in a field of Q. 813, to trace the influence of the temperature and rainfall on the rate of cane growth. It has been shown in Hawaii that there is a very close correlation between temperature and cane production when other limiting factors (moisture supply, plant food, materials, &c.) are excluded. In the Bundaberg area, soil moisture is the factor which most generally limits cane growth, and it was thought that its importance might be brought out in progressive growth studies.

A field of plant Q. 813 was selected for the purpose. The crop was six months' old when the measurements were commenced in March 1929. A dry spring had seriously retarded growth, and it was not until March that cane was being made. The measurements were made at fortnightly intervals until 8th August, when the crop was harvested.

The results are shown graphically in the accompanying diagram :—




Following good summer rains, the crop made rapid progress during the latter half of March. The soil moisture supply was adequate until the middle of April, but with the decline in temperature the growth rate fell off rapidly. In other words, cane production had just begun towards the end of the growing season.

It has been demonstrated that active cane growth takes place only when the mean temperature is above 70° F. This point was reached by the 17th April, when the growth rate was reduced to one-half of that during the middle of March. Dry conditions in April influenced this falling-off, for after a rainfall of 2 inches on 19th April the growth rate increased once more, but continued dry conditions brought about a further retardation until the rains of June, which brought about a further period of active growth, despite the low mean temperature.

**Work of the Southern Sugar Experiment Station**—*continued.*

The growth rate curve shows, then, that there is a definite correlation between temperature and cane growth, but where rainfall is a limiting factor the influence of dry conditions dominates the rate of growth.

Further measurements will be made during the coming season to study further the influence of rainfall in this regard, and also to follow the growth of cane under various fertiliser treatments.

## DETAILED REPORT OF ANALYTICAL WORK PERFORMED AT THE LABORATORY OF THE SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG, FROM 1st NOVEMBER, 1928, TO 31st OCTOBER, 1929.

| Materials. | Number of Analyses. |
|---|---|
| Sugar canes and juices for growers | 413 |
| Sugar canes and juices for Agricultural Show, Bundaberg | 190 |
| Sugar canes and juices for Agricultural Show, Gin Gin | 212 |
| Sugar canes and juices for Agricultural Show, Maryborough | 44 |
| Sugar canes and juices for Agricultural Show, Pialba | 74 |
| Sugar canes and juices for Experiment Station | 92 |
| Total | 1,025 |

## FIELD DAY.

The Annual Field Day of the Southern Sugar Experiment Station was this year held on the 1st June, when a large number of farmers and others interested in the industry from the Southern sugar districts assembled at the station.

In the absence of the Director, who was on long-service leave, the visitors were welcomed by the Acting Director, Dr. H. W. Kerr, who also delivered an address which was followed by addresses from Mr. A. F. Bell (Pathologist) and Mr. R. W. Mungomery (Assistant Entomologist).

Luncheon was served at midday, after which there was an interesting demonstration of tractors and field implements.

## TOTAL TONNAGE OF CANE HARVESTED FROM THE SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG, DURING 1929.

| | Tons. |
|---|---|
| Cane sent to mill | 291·75 |
| Cane cut for plants | 7·00 |
| Total | 298·75 |
| *Nature of Crop*— | |
| Plant cane | 160·60 |
| First ratoon cane | 123·80 |
| Standover plant | 14·35 |
| *Tonnages*— | Per cent. |
| Q. 813 | 85·06 |
| Varieties | 14·94 |
| Acres harvested | 18·5 |
| Average tons per acre | 16·15 |

## 5.—Work of the Division of Pathology.

### REPORT BY MR. A. F. BELL.

#### District Inspections.

For the purpose of assisting farmers to obtain supplies of disease-free cane for planting, disease surveys were made in the following main districts:—Giru, Lower Burdekin, Proserpine, Farleigh, Pleystowe, Sarina, Bundaberg, Maryborough, Bauple, and Moreton.

These surveys were carried out by officers who visited each district for that specific purpose. While this system is quite adequate for the control of diseases such as mosaic, Fiji, and downy mildew, it is by no means completely satisfactory when dealing with leaf-scald and gumming diseases. Experience, and particularly that of the past two years, has demonstrated that cane affected with either of these two diseases may exhibit no readily apparent symptoms throughout the greater part of the year, and yet suffer heavy mortality at maturity during the dry period of September-November. In the presence of these diseases advice on seed selection should be given by a resident field officer who has a first-hand acquaintance with all farms in his mill district, and who has the cane continually under his observation *throughout the year.*

Upon completion of the surveys, where considered desirable, there were published lists of the farms on which the cane appeared suitable for seed purposes. In addition, Bauple and Farleigh farmers who had gumming disease or excessive amounts of mosaic in their cane were advised by circular letter to refrain from planting their own cane.

At this point it is of interest to note an incident which it is devoutly hoped is not typical. At the conclusion of the Farleigh district survey we published a list of the small percentage of growers who were the fortunate owners of disease-free farms. A few weeks later one of these particular growers was observed, in another mill district, cutting plants in a field where the cane was known to be infected with mosaic to the extent of 5 to 10 per cent. In answer to a query as to why he took the risk of introducing disease in this manner, in preference to planting his own disease-free cane, he stated that he "believed in a change of seed."

Giru.—An inspection of seventy-one farms in the main Giru area revealed a reasonably satisfactory state of affairs. Fifty-nine farms were free from major diseases, and of the remaining twelve mosaic was found on seven and downy mildew on five; in each case the variety was B. 208. Orders to eradicate the diseased cane were issued to the owners of the five farms on which downy mildew existed and one farm on which the amount of mosaic was excessive. It cannot be over-emphasised that, in order to preserve this desirable state of comparative freedom from disease, the Giru farmers must refrain from haphazard introduction of cane from other districts.

A rapid survey of a proportion of the farms at Rollingstone and Ingham, which supply Giru, indicated that although the cane is generally healthy the presence of gumming disease on a few farms is a menace to the Giru and other Ingham growers.

Lower Burdekin.—With the exception of downy mildew in B. 208, the cane in this district continues to be generally free from major diseases, and top rot was not much in evidence this year. Several large plantings of B. 208 from seed recommended by the Bureau have been made, and it is expected that good supplies of disease-free seed cane will be available next year. There is little doubt that this disease can be controlled in the Burdekin by the use of clean seed and the elimination of ratoons.

Proserpine.—Farm to farm inspections were carried out in the Breadalbane, Glen Isla, Waterson, Banana Pocket, Up River, and Hamilton Plains sections, and with the exception of Up River and Waterson the disease situation appeared satisfactory. Red rot was found to be generally distributed, especially in H.Q. 426, and downy mildew was found in B. 208 on two or three farms. In the Waterson and Up River sections, which flank the Proserpine River, mosaic disease is very prevalent, and, due to the presence of so much grass on the river-bank headlands, the secondary spread is rapid. It appears necessary that some of these farms be planted to mosaic-resistant varieties only.

Farleigh.—The outstanding important disease in this district is mosaic, which is widely distributed, but particularly bad in Habana and the contiguous areas of Barcoo, Millicent, and Etourie. Here the greater number of the farms are on hillsides where adequate cultivation is difficult and conditions favourable for a rapid secondary spread of the disease. For this reason, the fact that many farmers are too impoverished to purchase cane for planting, and the inability of many non-British farmers to understand English, the complete control of mosaic by seed selection and roguing does not appear practicable. We have therefore set out trials in order to find suitable mosaic-resistant varieties.

Gumming disease was found on some sixteen Farleigh farms; the disease appears to be present only in the leaf-streak stage and is causing no obvious loss. Nevertheless the situation has a very serious aspect, inasmuch as the new varieties P.O.J. 2714, S.J. 2, and S.J. 4, which show some promise in this district, are unduly susceptible to gumming disease. It is quite possible that the presence of this small amount of gumming disease might eventually prove to be the limiting factor in the growth of these varieties, unless the situation is taken in hand.

Pleystowe.—In the main Pleystowe area red rot and mosaic are generally distributed but do not appear to be responsible for severe losses. A serious factor is the presence of leaf-scald in H.Q. 426 on farms in the Palmyra section. H.Q. 426 is quite susceptible to this disease, and no seed of this variety, at least, should be drawn from Palmyra and the adjoining territory.

Mosaic is bad in certain sections, particularly in Habana, Silent Grove, and parts of Gargett,

**5. Work of the Division of Pathology**—*continued.*

mainly due to negligence rather than ignorance on the part of the farmers. The North Coast farms are generally free from disease and should prove good sources of seed cane, with the exception of Cameron's Pocket, where mosaic is common.

Sarina.—Mosaic and red rot are the only major diseases reported as the result of the survey which is being carried out in this district, and the main problem is to prevent the introduction of diseased cane from other districts. Mosaic is of importance only in certain restricted localities, and red rot is responsible for much less damage than in former years.

Bundaberg.—Mosaic is all too common on Burnett River farms, and calls for the serious attention of the growers. Gumming disease continues to be of paramount importance, particularly on the deep scrub soils of poor water-holding capacity. This disease is so widespread that a complete change-over in standard varieties appears imperative, and every effort is being made to develop suitable resistant varieties.

As a result of a special series of surveys of farms on the borders of the district, a list was compiled of some twenty-seven farms on which no symptoms of gumming disease were found on any inspection. This list was widely advertised for the benefit of such farmers as desired to purchase seed cane.

Maryborough.—Of a total of 196 farms inspected, Fiji disease was found on 96 and mosaic on 113. The Fiji situation shows no definite improvement over that prevailing last year, and it will apparently be necessary to abandon the varieties D. 1135 and 1900 Seedling in certain parts of the district. No Fiji disease is reported from Pialba, where the cane is generally free from disease.

Bauple.—Mosaic has decreased in amount since the previous survey, but there is still room for a good deal of improvement. Gumming disease has been found on about a dozen farms, mainly in the varieties D. 1135 and E.K. 28. The presence of gumming in the district must be viewed seriously, as the climatic conditions are such as to warrant the belief that the losses due to the disease would be as great as in the Bundaberg district.

Moreton.—Gumming disease is widespread in the Moreton district, but owing to the greater proportion of the resistant variety Q. 813, and the more favourable climatic conditions, the situation is better than in Bundaberg. Seed selection of susceptible varieties within the district is now practically impossible, and efforts are being made to obtain resistant varieties which will replace H.Q. 285, D. 1135, and Badila.

Leaf-scald is reported from one farm, and it will probably prove desirable to quarantine this property. A further outbreak of Fiji disease has occurred on three farms, but prompt steps have been taken to deal with the outbreak.

### Gumming Disease.

Gumming disease continues to be the main pathological problem of Southern Queensland, and is slowly spreading into hitherto clean localities. The damage caused by the disease was accentuated this year by reason of the very dry spring. Efforts are now being concentrated on the development of resistant varieties with which to replace the standard susceptible varieties. This work is somewhat complicated by the fact that, as observations must be continued until October-November, the results of the trials are not obtainable until some time later than the normal time of planting.

On my return from abroad, I found a considerable amount of uncertainty as to the relative resistance of varieties then being grown commercially; that one variety appeared more resistant than another may have been due to the fact that the former had not been grown in contact with the disease for the same period as the latter, and so on. In order to obtain definite information on this subject, and also to test some new varieties, a gumming resistance trial was planted with healthy seed of the following varieties:—Q. 812a, Q. 813, Q. 1098, M. 28/10, M. 55, M. 189, Badila, H. 227, P.O.J. 2714, Uba, Co. 210, Co. 213, Co. 227, Oramboo, Nanemo, Korpi, B.H. 10/12, and S.C. 12/4.

Unfortunately, the trial was almost completely ruined by the heavy frosts of early July, which killed every stick of all varieties except the Coimbatore canes and Uba, in which the percentage of death was low. In addition these four varieties appeared to be unaffected by gumming disease, and a "sweating" test applied to approximately forty dead sticks of each variety produced no oozing of gum in the case of Co. 210, Co. 213, Co. 227, Uba, and B.H. 10/12. In all other varieties, gum oozed to a greater or less degree. While very unsatisfactory, this trial leads us to believe that the Coimbatore canes show sufficient promise as gum resisters to be placed in variety yield trials, and a number of such have been laid out. In the meantime the resistance to gumming is being further tested.

*Resistance of Miscellaneous Varieties.*—A number of varieties growing in the nursery (not isolated) of Bingera plantation were planted out in single plots of several rows and subjected to natural infection. The growing conditions were comparatively favourable, and it was not to be expected that the effects of gumming would be as marked as under the drier conditions of the Woongarra scrub country, for instance. That is to say, a cane which is apparently highly resistant at Bingera may not prove to be more than moderately resistant when grown on the Woongarra. The trial was concluded on 25th October.

*Results.*—

| Variety. | % Death. |
|---|---|
| Yellow Caledonia .. .. | 0 |
| H. 227 .. .. .. .. | 0 |
| M. 55 .. .. .. .. | 0 |
| M. 189 .. .. .. .. | 1·5 |
| Q. 1098 .. .. .. | 2·0 |
| P.O.J. 2714 .. .. .. | 4·5 |
| N.G. 24 .. .. .. .. | 32 |
| E.K. 28 .. .. .. .. | 50 |
| Q. 694 .. .. .. .. | 70 |

*Conclusion.*—These results suggest that Yellow Caledonia and H. 227 should prove resistant on the forest soils of Bingera, and now require to be tried out on a yield basis.

While no death was observed in the variety M. 55, almost every leaf showed streaks, and in

**5. Work of the Division of Pathology**—*continued.*

other parts of the district the cane (while showing no death) oozed gum profusely. Moreover, this cane was thrown out by the Sugar Experiment Stations some years ago on account of its low density, and it cannot be recommended at this stage.

*Resistance of S.J. and P.O.J. Seedling Canes.*—A single plot (consisting of two short double rows) planting of disease-free S.J. and P.O.J. canes was made at Windermere in 1927, and subjected to natural infection. The cane was harvested in November 1928, and canes which were apparently sound were then planted out on a larger scale, and the percentage of death ascertained on 31st October, 1929.

*Results.*—

| Variety. | 1928 Harvest. | | | 1929 Harvest. |
|---|---|---|---|---|
| | % Dead Stalks. | % Stalks Oozing Gum. | % Apparently Sound. | % Dead Stalks (Approx.). |
| S.J. 2 .. | 17 | 50 | 33 | 30 |
| S.J. 3 .. | 1 | 31 | 68 | 30-40 |
| S.J. 4 .. | 95 | 5 | 0 | — |
| S.J. 5 .. | 2 | 33 | 65 | 25 |
| S.J. 15 .. | 5 | 9 | 86 | 10-15 |
| S.J. 16 .. | 2 | 10 | 88 | 8 |
| S.J. 28 .. | 27·5 | 45 | 27·5 | — |
| S.J. 468 .. | 12 | 36 | 52 | 15-20 |
| P.O.J. 213 .. | 7 | 5 | 88 | 3 |
| P.O.J. 2714 .. | 8 | 45 | 47 | 15 |

*Conclusion.*—With the possible exception of P.O.J. 213 it does not appear that these varieties can be grown in any locality in Southern Queensland where gumming disease is present.

Four further trials have been commenced this season with the object of testing the resistance of some sixty-five varieties.

### Fiji Disease.

This disease is generally distributed in the Maryborough and Beenleigh districts, but outbreaks were discovered during the year on farms of suppliers to the Moreton and Bingera mills.

We are of the opinion that this is the disease which constitutes the chief menace to the main sugar areas of North Queensland, and within the next few years it may become advisable to adopt drastic measures in order to bring the disease under absolute control in Maryborough and Beenleigh.

For the purpose of determining relative varietal resistance to Fiji disease, two trials of twenty-five varieties have been planted out in localities of rapid secondary spread in the Maryborough district.

### Mosaic.

A disease believed to be mosaic was observed in several stools of the commercially immune variety, Uba, growing in a field at Foulden, Mackay. The symptoms were atypical on all but the youngest fully developed leaf, and diagnosis was difficult.

Three small outbreaks of mosaic were detected in the Cairns district, and the diseased plants rogued out in each instance. This disease constitutes a major problem in parts of Proserpine, Farleigh, Pleystowe, Bauple, Maryborough, and Burnett River, and in these areas the control of the disease merits more attention than it receives.

Experiments are being carried out with the object of determining varietal resistance to mosaic and losses occasioned in susceptible varieties, and attempts are being made to repeat the recently reported leaf puncture transmission of mosaic in Porto Rico.

### Top Rot and Spindle Top.

The incidence of top rot on the Lower Burdekin was low during the past year, and little damage was observed; nevertheless several small plantings of the new variety P.O.J. 2714 were badly diseased, which suggests that this variety will prove quite susceptible to top rot.

Top rot and spindle top (*Sclerotium* spp.?) were much more in evidence in the far North than usual, this being due, it is believed, to the unusually dry spring followed by an intense and prolonged rainy season. Field observations indicate that these two diseases are of economic importance only when the early growth of the cane has been retarded by unfavourable conditions. Such conditions include—(1) late planting; (2) late fertilisation, particularly with nitrogenous fertilisers; (3) close planting (with its consequent overcrowding, giving a larger number of thin weak sticks rather than a smaller number of stouter sticks, per ton of cane); (4) shallow drilling; (5) bad seed-beds; (6) highly acid soils; (7) lack of particular plant foods; (8) inadequate cultivation; (9) dry spring weather; and (10) intense and prolonged rainy season. The detailed investigation of top rot, and possibly spindle top, will be undertaken by Mr. Dormer on his return to the Bureau.

### Sour Rot.

This disease has been somewhat prevalent in the Lower Burdekin this year, especially in the variety H.Q. 426 and to a less extent in E.K. 28; it could readily be found in practically every field of the former variety during July-August. The external symptoms are essentially similar to those of severe red rot; as in the case of red rot one or all the sticks in a stool may be killed. Internally, a rot commences with a general yellowish discoloration of the storage tissue, usually restricted to the upper part of the stem. The tissue gradually turns brown in colour, and a sour rot with a faint disagreeable odour is produced. The rotting extends outwards to the rind of the cane and may or may not extend into the base of the stick. Usually the extreme base of the cane, at least, is apparently healthy; later, the storage tissue becomes pithy and, finally, large longitudinal cavities are produced. The discoloured portions of the stick are very brittle, even in the early stages. The disease is provisionally termed sour rot; it appears to me to have much in common with the "Bacteriosis" of Java.

All cane affected was in need of irrigation and appeared to have passed the point of maturity, giving the impression that the disease is one of over-ripe cane. The variety mainly affected, H.Q. 426, is generally considered to be a ten months' cane, but in this district is harvested at about fourteen months. It is proposed to make observations next year in conjunction with time of maturity tests.

**5. Work of the Division of Pathology**—*continued.*

Preliminary observations were made on a top rot occurring in the Mackay district, which has some features in common with sour rot.

### Miscellaneous Diseases.

As a result of a series of inoculation tests with P.O.J. 2878 and other varieties, carried out by Mr. D. S. North, it has been proved that strains of *Fusarium moniliforme* capable of causing fusarium pokkah boeng were present in Australia prior to the introduction of P.O.J. 2878 from Java. It is therefore to be expected that this variety will contract the disease when field plantings are made.

Stem gall disease was found to a very limited extent on Badila in the Sarina district.

The cane-killing weed (*Striga* sp.) was observed in Giru, Ayr, and Sarina, no previous record of its occurrence in these districts being on file.

A brownish rot at the base of the cane stool, caused by *Corticium* sp., has been reported on a few occasions. In each instance the disease was found in new land where the tree-stumps were still standing, the fungus evidently having passed across from the stumps to the cane.

A somewhat irregular longitudinal white streak, suggestive of leaf-scald, was frequently observed on the leaves of certain canes during the Proserpine survey, although it had previously been noted in other districts. No other symptoms suggestive of leaf-scald were found, nor was any organism cultured when plantings of leaf-streak tissue were made on P.D.A. or cane-juice agar. A comparison of some of this material with some photographs in the possession of Mr. J. P. Martin, of the Hawaiian Sugar Planters' Association, revealed that this type of leaf-streak had been observed by Miss Wilbrink in Java. Efforts to find an associated organism have also been unsuccessful in Java.

### Varieties.

Two new varieties, the Coimbatore Seedlings Co. 281 and Co. 290, were received from India in March, and are growing in quarantine. Preliminary trials in the West Indies indicate that Co. 281 is an early maturing cane.

The Brandes 1928 collection of New Guinea canes, growing in quarantine in Sydney, was inspected in February through the courtesy of the Colonial Sugar Refining Company; 124 varieties germinated, and of these about one-sixth are non-noble canes. As approximately 100 canes of the collection were received from districts explored by previous expeditions, it is to be expected that a large proportion of these will duplicate canes already introduced into Australia from New Guinea. It is of interest to note that both mosaic and Fiji diseases were reintroduced in cuttings of this collection.

The varieties which had been grown in private gardens for a year proved to be free from disease, and have been concentrated in one garden ready for removal to a variety garden when such is established.

### Isolation Plots.

Atherton Tableland Nursery Scheme.—The initial planting of Badila made by the Cairns Cane Growers' Association has been extended on the Tableland, and it is anticipated that some distribution of seed will be possible next year.

Tully.—The Tully Mill Suppliers' Association is making inquiries with a view to establishing a similar scheme for the supply of disease-free cane for the Tully area. Supplies of healthy seed-cane are particularly necessary in Tully on account of the large amount of leaf-scald rendering seed selection impossible on most farms. Our recent inspections show that much of the damage attributed to grubs is really caused by leaf-scald, which means that the importance of leaf-scald is being under-estimated.

Bundaberg.—Proposed nursery sites were inspected on behalf of the Bundaberg District Executive, and a number approved. However, nothing further has been heard of this scheme, the Executive evidently having let the matter drop.

### Identity of Varieties.

An examination of the number and distribution of the hair groups on the bud-scales and leaf-sheaths of the varieties Badila, Tableland Badila, and Oba Badila (growing on the Mackay Experiment Station) supports the contention that the three canes are identical.

### Development of Cane Arrows.

With a view to determining the possibility of cross fertilisation of cane varieties and seedling raising at Mackay, an investigation was made into the development of the flowering parts of several varieties, in different localities. Although viable pollen (as determined by the iodine test) was shed by a number of varieties, in no case did the ovaries appear fully developed. A number of arrows were collected and forwarded to South Johnstone Experiment Station, but, on sowing, failed to give rise to a single seedling. It does not appear likely, therefore, that the actual crossing of the canes can be undertaken at Mackay, and this bears out the results of experiments made several years ago at the Sugar Experiment Station at Mackay.

### Laboratory and Equipment.

The necessary equipment for the Pathology Laboratory has been purchased, and it is expected that the new building will be ready for occupation on or about 1st January, 1930.

## 6. Work of the Division of Entomology.

Entomological laboratories are situated at Meringa (near Cairns), Mackay, and Bundaberg. Reports from the Entomologist at Meringa (Mr. E. Jarvis), Assistant Entomologist at Mackay (Mr. A. N. Burns), and the Assistant Entomologist at Bundaberg (Mr. R. W. Mungomery), appear under this section.

### ANNUAL REPORT OF MR. E. JARVIS, THE ENTOMOLOGIST AT MERINGA, 1928-1929.

At the present time, *Lepidoderma albohirtum* Waterh. must still be considered our principal cane-beetle; while *Rhabdocnemis obscurus* Boisd. and *Lepidiota frenchi* Blkb. rank second and third, respectively, in economic importance.

**6. Work of the Division of Entomology—*continued.***

Caterpillars of the army worm (*Cirphis unipuncta* Haw.) occasionally appear in sufficient numbers to cause alarm, and call for prompt treatment.

Leaf-eating coleopterous, orthopterous, and homopterous insects occurring in canefields continue to be of minor interest from an economic standpoint, being held in subjection by their various predaceous and parasitic enemies.

With regard to the number of species of class Insecta attacking sugar-cane in North Queensland, the total number does not exceed more than about 41; so that in this respect we are better off than the growers in Java, where no less than 131 insect pests of sugar-cane (some of which, of course, do little damage) have been recorded by Dr. E. H. Hazelhoff.

It is interesting, however, to note that these include 21 species of scarabæid cane-beetles, as against 13 in Queensland; and that about 16 of our own destructive species occur also in the canefields of Java.

The notorious greyback cockchafer (*L. albohirtum*) has been much in evidence during the past season, although damage from grubs of this pest did not this season reach the dimensions attained during the years 1911, 1917, and 1921.

In some of our cane areas grub infestation was more sharply localised than on others; such being the case over plantations occupying high ground, or on soils of volcanic formation, &c.

It is pleasing to be able to record that cane-growers are taking more interest in economic entomology than has been the case during past years. Several farmers, for instance, in the Cairns and South Johnstone districts are beginning to realise the fact that it pays to make an effort to combat outbreaks of army worms or grass caterpillars, which at times threaten to strip the leaves of young cane plants, &c.

Some of the more interested growers have purchased spraying equipment necessary for this work, while others are keen on witnessing field demonstrations regarding methods of preparing and applying arsenical sprays against such leaf-eating caterpillars, as carried out by officers of this Sugar Experiment Station.

Increasing activity is also being displayed by the Colonial Sugar Refining Company in experimental control work in connection with the grubs and beetles of our greyback cockchafer; the results of which have proved sufficiently encouraging to warrant a continuance of such work along more extensive lines during the coming season.

### Queensland's Principal Insect Pests of Sugar-cane.

Regarding the economic status of our greyback cockchafer, I may state that, unlike several closely related Scarabæidæ occurring in other countries (genera *Lachnosterna* and *Melolontha*), which have a life-cycle of from two to three years, the life of our Queensland species, *Lepidoderma albohirtum* Waterh., from egg to adult beetle is completed in twelve months. It is probably due to this fact, coupled with the large size and voracity of its grubs, that we must attribute those capabilities for destruction which during seasons of normal rainfall have enabled this insect to take first place as a pest of sugar-cane.

### Poisoning Feeding-trees of the Greyback Cane-beetle.

Investigations in this connection during the present season have been based largely on results obtained during past years. This branch of control work, which was first initiated by the present writer in January 1915, was taken up again in 1921, and later in 1926.

The apparatus used in experimental work carried out in the 1928-29 season consisted of light wood frames made of fillets, covered on the sides and top with mosquito netting, and enclosing a space of 80 cubic feet, which were placed over young trees of *Ficus pilosa* 4 to 5 feet high growing at the Experiment Station. The two poisons tried were calcium arsenite and lead arsenate, the former being made up in the proportion of sodium arsenite 8 oz., lime (unslaked) 6 lb., water 20 gallons; while the arsenate of lead in the latter spray was applied in the proportion of 8 lb. to 40 gallons of water.

Effect of Lead Arsenate on Cane-beetles.—In this experiment 100 specimens of greyback cockchafers—which had probably not been on the wing more than four days—were collected from feeding-trees on 26th November, and enclosed at once in the frame. The foliage of the trap-tree was sprayed with lead arsenate (2-8 formula) to which a little casein had been added to ensure even spreading.

Mortality of the beetles commenced after the second night of feeding, continuing at intervals until 5th December, as shown by the following table:—

*Mortality of Beetles eating Leaves sprayed with Lead Arsenate.*

| 1928. | Beetles Alive. | Beetles Dead. | Escaped. |
|---|---|---|---|
| November 26 .. | 100 | .. | .. |
| November 27 .. | 99 | 1 (female) | .. |
| November 28 .. | 85 | 14 (6 males, 8 females) | .. |
| November 29 .. | 64 | 13 | 8 |
| November 30 .. | 54 | 10 | .. |
| December 1 .. | 48 | 6 | .. |
| December 3 .. | 9 | 35 (12 males, 23 females) | 4 |
| December 5 .. | 0 | 9 | .. |
| | .. | 88 | 12 |

None of these hundred greybacks lived longer than ten days after capture; and, as portions of several of the sprayed leaves had been eaten, we may assume that about 75 per cent. of the beetles either nibbled the edges or devoured small pieces of the poisoned epidermis, as shown by damaged leaves on this tree.

Fully 80 per cent. of the specimens harboured by day in the moist soil provided for them, although some were often found resting in a torpid condition on the sides of the cage or on leaves of the fig-tree. A large percentage of the dead beetles were discovered in the soil into which they had burrowed after feeding on the poisoned leaves, while the remainder were found lying on the floor of the cage or under debris (pieces of bark, &c., provided for such purpose).

**6. Work of the Division of Entomology**—*continued.*

In similar frames of netting placed over fig-trees on cultivated land, the soil was allowed to form the floor (16 square feet in size); and in these cages practically all the cockchafers passed the day underground, very few remaining on the netting or leaves after daybreak.

Another cage of similar size which was put over a fig-tree sprayed on 17th November with arsenate of lead (2 lb. to 10 gallons water) gave a mortality of two female beetles on the following day; proving that lead arsenate when applied at this strength is very deadly to our cockchafer beetle. Furthermore, it does not injure the leaves of such trap-trees or check growth of the budding foliage at ends of the young shoots.

**Notes on Biological Control of Caterpillars.**

Among the numerous natural enemies belonging to class Insecta which wage perpetual warfare against caterpillars of various species of lepidoptera, some of the so-called "ground beetles" (Carabidæ) occurring commonly in our canefields happen to be of decided economic interest.

On 15th September the present writer confined a specimen of *Rhytisternus carpentarius* S. in a small breeding cage, in order to make a preliminary study of its range of dietary whilst under confinement. This carab measured about 18 mm. in length, and in general appearance is lustrous black, with exception of the antennæ and tarsi, which are dark reddish, the latter being provided with stiff hairs. The upper surface of body is much flattened, the elytra having about 12 decided dorsal striæ, and 3 striations on the side of each elytron. At intervals of from four to seven days the following miscellaneous insects were killed and devoured by this predaceous beetle:—Two large sarcophagid flies; a caterpillar of *Cirphis unipuncta* Haw., about 1¼ inches long; a grub of *Isodon puncticollis* Macl. in the third instar; a pupa of *Dichocrocis punctiferalis*; two cockroaches (*Periplaneta americana* and a smaller arboreal species); and a caterpillar of *Laphygma exempta* Walk. The harder chitinous portions, such as the head and mandibles of larvæ, and wings and elytra of the dipterous and orthopterous insects respectively, were invariably rejected. Between the dates 3rd November to 15th April, the beetle was fed at weekly intervals with a sarcophagid fly and small caterpillars. On 14th to 20th May, it devoured four caterpillars of *Agarista agricola*, about 1 inch long; while on 8th August a larva of *Chloridea obsoleta* fell a victim. This beetle died about the middle of August, so lived for eleven months in close confinement.

Another of our very useful carabæid beetles is *Chlænius australis* Dej., some of the predatory habits of which were first recorded by the writer in 1921 ("Queensland Agricultural Journal," vol. xvi., p. 278).

Both the adult and larval forms of this insect were observed destroying caterpillars of *Laphygma exempta* Walk. which were doing great damage to the leaves of sugar-cane and maize during February. It is interesting to note that during 1919 a species of *Chlænius* (possibly *C. australis*) was introduced into Hawaii from North Queensland by the Sugar Planters' Association; presumably for the purpose of combating army worms.

Several species of this valuable genus of Carabidæ prove very useful in other parts of the world against various lepidopterous insect pests. *Chlænius tomentosus*, for example, helps to control the ravages of the tobacco wire-worm (*Crambus caliginocellus* Clem.) in Virginia, and is believed also to be predaceous on grubs of *Lachnosterna* in America.

**Proportion of Sexes in Greyback Cockchafer.**

Data obtained by collecting several hundred specimens from food-plants growing just outside this Experiment Station showed that on 19th November (about a week after emergence of these beetles) 60 per cent. of those captured proved to be of the female sex; while out of another collection made the following day (20th November) 198 were females. Nineteen days later an additional 400 greybacks yielded a percentage of 43 females, indicating that the period of oviposition was in progress.

**Response of Greyback to Phototropic Influences.**

In view of the report published by Mr. R. W. Mungomery (Assistant Entomologist at the Bundaberg Sugar Experiment Station) in the "Australian Sugar Journal," vol. xix., pp. 656-657, in which he stresses the very unimportant phototropic reaction manifested by female beetles of our Southern cockchafer, *Pseudholophylla furfuracea* Burm., it is advisable to again mention that such degree of negative reaction does not apply to our Northern cockchafer, *Lepidoderma albohirtum* Waterh. The various experiments in this connection carried out with acetylene light against the beetles of *albohirtum* are briefly outlined in the above-mentioned Sugar Journal in vol. xx., pp. 167-68, where it is shown that both sexes of our notorious Northern species are strongly attracted to artificial light.

Last November a beetle trap designed a few years ago by the present writer was fitted with an electric lamp of 32 candle power, in order to see if such form of illumination would prove as attractive to these insects as acetylene light.

This trap was placed close to a weeping-fig tree (*Ficus benjamini*) on which a number of greybacks were feeding; and in less than two hours 80 beetles were captured, 41 of which proved to be of the female sex. It was found also that setting this lamp in a deeply concave reflector of about 8 inches diameter did not, apparently, make the light more attractive.

**Breeding and Distributing Parasites of the Weevil-borer.**

The increase of *Rhabdocnemis obscurus* Boisd. having been augmented, as was expected, by conditions brought about by the last cyclone, special attention has been bestowed on the breeding of *Ceromasia sphenophori*, with the result that during the last few months (April to August) 1,127 living specimens of this Tachinid fly were reared at Meringa Experiment Station, and released on thirty-one different selections amongst borer-infested cane. In addition to these consignments, field-boxes were established at Mourilyan and Mount Sophia, containing in all about 150 puparia of *C. sphenophori*. Liberations of living Tachinid flies were made on mill

**6. Work of the Division of Entomology—*continued.***

areas of the following districts:—South Johnstone, 463 specimens; Goondi, 295 specimens; Babinda, 232; Mulgrave, 107; and Mourilyan, 30 specimens.

### Official Collection of Insects.

A few hundred additional insects have been added to our small museum collection during the last twelve months.

At present the number of specimens contained in store-boxes and show-cases is 7,098; while the species show a total of 2,157, as against 2,091 recorded in my last annual report.

Of these species, 961 belong to group Coleoptera (beetles); 384 to the Hymenoptera; 291 to the Diptera; and 204 to the Lepidoptera; the remaining 317 species finding places in the groups Orthoptera, Hemiptera, Neuroptera, and Isoptera.

Additional accommodation for the exhibition of diagrams and show-cases illustrating the life-histories of primary cane pests has been provided, by the building of a small room attached to the existing museum, which allows more space for the display of entomological specimens, &c.

Last January we forwarded a glass-topped show-case containing a representative collection of insect pests of sugar-cane to Mourilyan; this being a presentation from the Bureau of Sugar Experiment Stations to the School of Arts in that district.

### Publications.

The following Monthly Reports, together with other miscellaneous publications dealing with research work and other activities carried out in connection with the control and life-history economy and study of insect pests of sugar-cane, were submitted by the writer to the Director of the Sugar Bureau during the last twelve months.

*Monthly Progress Reports.*—Appearing in the "Queensland Agricultural Journal":—

1928—

September: Vol. xxx., pp. 194-95. Effect of drainage on cane diseases, and on growth of sugar-cane.

October: Vol. xxx., p. 320. Attraction of entomology for the rising generation.

November: Vol. xxx., pp. 510-11. Biological control of caterpillars attacking sugar-cane. Emergence of greyback cockchafers.

December: Vol. xxx., pp. 518-19. Biological control of cane insects. Success of paradichlor. in Russia against *Polyphylla fullo* L. Review of past field tests with paradichlor. in Cairns district.

1929—

January: Vol. xxxi., pp. 23-25. Queensland's principal insect pest of sugar-cane. Emergence of *Lepidoderma albohirtum* Waterh. Proportion of sexes of *albohirtum*.

February: Vol. xxxi., pp. 108-110. Notes on poisoning greyback cockchafers: effect on same of lead arsenate and calcium arsenite.

March: Vol. xxxi., pp. 204-05. Preventing oviposition of *L. albohirtum*. Valuable hints on grub fumigation.

April: Vol. xxxi., pp. 337-38. Successful trapping of *Rhabdocnemis obscurus* Boisd. Scattered cane-blocks a mistake. Destroying grubs of greyback cockchafer.

*Some Notes on the Economy of Cockchafer Beetles.*—These notes were published as Bulletin No. 20, Div. of Ent., which contains 36 pages of letterpress and 6 full-page plates in illustration.

## Report of the Assistant Entomologist (Mr. A. N. Burns) for the year ending 31st October, 1929.

### Survey and Extent of Grub Damage during the 1928-1929 Summer.

Undoubtedly the greatest proportion of injury to cane during the past season has been wrought by grubs of the greyback beetle (*Lepidoderma albohirtum* Waterh.). Generally speaking, damage caused by this pest was far more extensive than it has been for many years, and it has even been stated, by some growers of long standing in the district, to have outclassed anything previously observed by them.

*Frenchi* grub damage (*Lepidiota frenchi* Blkb.) on the other hand was more localised and not so extensive as it was during the previous season. Although this species has a two years' life-cycle, the magnitude of the flights noted by the writer both in the 1927 and 1928 summers appeared to present little difference. Seasonal conditions apparently affect the size of the flights of this beetle far more than the belief that, because it has a life-cycle that occupies two years, therefore every second year there will be a greater flight than in the intervening seasons.

Many farmers who have not before been troubled with greyback grubs have experienced more or less serious injury from them last season. Taking the district as a whole, the most general and serious infestation was observed in the Mia Mia, Owens Creek, Habana, and The Leap areas, whilst severe local infestations were recorded from West Plane Creek, Farleigh, Hampden, Finch Hatton, Richmond, and Foulden. Small areas of grub-attacked cane could be observed at many other places in different parts of the district.

In some places much of the injury did not cause the cane to die off until fairly late in the season, i.e., April and May, and then, with the appearance of several early frosts which cut the cane very severely in many areas, the actual extent of the damage attributed to grubs could not be very easily ascertained. In the Farleigh and Habana areas, which are chiefly hilly and therefore not so subject to the influence of frosts and cold nights, grubs were being ploughed up from cane-roots as late as the end of July, whilst, only three weeks later, well-advanced pupæ were found in the Sarina district.

### Flighting of Beetles, Greybacks and Frenchi.

The first soaking rains of last summer fell early in November 1928, and these were immediately followed by an emergence of *frenchi* beetles in the immediate vicinity of the Experiment Station. This flight lasted for two more nights only. No further heavy rains fell until nearly three weeks later, and they were at once followed by a general emergence of greyback beetles and the main flight of *frenchi* beetles. The latter species remained in evidence for a

month or more; the greybacks also practically all emerged within the first two weeks of December 1928, and remained in evidence right up until the end of January 1929.

**Summary of other Pests of Importance.**

Weevil or New Guinea Borer (*Rhabdocnemis obscurus* Boisd.).—This pest, which is so plentiful in the cane areas north of Ingham, fortunately appears so far to be very sporadic in its distribution in the Mackay district. During the past year only three applications have been received for liberations of the Tachinid fly parasite (*Ceromasia sphenophori* Vill.) to combat it. In each case the cane attacked was Badila which appears to be the favoured variety, and in each of the farms the borers' presence could be traced to having been introduced with plants from more northern districts, if not at present at some time past.

Large Moth Borer (*Phragmatiphila truncata* Walk,).—The damage occasioned by caterpillars of this insect for the past year has been considerably less than that which was caused during the previous season, especially to young plant and ratoon cane. For a few weeks before the crushing commenced, a moderate amount of damage was noticed at different times in mature cane-sticks, in different parts of the district. The softer varieties only seem to be attacked, and of those observed Clark's Seedling (H.Q. 426) suffered the most.

Army Worms spp. (*Cirphis unipuncta* Haw., and *C. loreyi* Dup.).—The greatest amount of injury caused by these caterpillars usually appears during the months of July, August, and September. Young ratoons seem to suffer greater injury than plant cane. In comparison with last year, the damage caused this year was considerably less, and no general outbreaks or even any severe local infestations were noted. The young cane, with the exception of that which has suffered as a result of the unusually dry weather conditions which have prevailed for the past four months, appears to be remarkably free from attack by army worms and other leaf-eating insects.

Wireworms (*Monocrepidius* spp.).—Several severe and large infestations of these insects were brought under notice from Walkerston, Te Kowai, Farleigh, Habana, and Racecourse. In each instance the injury was confined to young plant cane, where the shoots were ring-necked and eaten off at the point of attachment with the sets, and in many cases the sets themselves were tunnelled into or the eyes destroyed. Control measures, consisting of placing poison baits in the furrows with the plants, were recommended in some instances.

New Lepidopterous Pest of Cane.—During the early part of the present month a new and interesting "moth borer" was brought under the writer's notice by a farmer at Peri. The caterpillar, which was over an inch in length when fully grown, was found eating off the young shoots of plant cane at ground level, and then eating the remaining portion down to the point of attachment with the stool. The cut ends of the sets themselves were in some cases bored into for a couple of inches or more, by examples of this borer. Superficially this insect very much resembles an army worm, but its habits are quite different, so that its identity cannot be ascertained until specimens are bred right through to the adult moth stage, at the laboratory.

**Experiments.**

Laboratory and Field Experiments against Cane Grubs.—Much time has been devoted to this particular branch of the work, and during the past grub season the principal work has been directed to the testing of fumigants against grubs (third stage) of the greyback (*L. albohirtum* Waterh.) and *frenchi* (*L. frenchi* Blkb.) beetles, both in the field as well as in the laboratory. Many of the mixtures used had not been previously employed against cane-grubs.

During the 1927-8 summer, as experimentation showed, the use of paradichlorobenzene in the crystal form gave very disappointing results; the heavy nature of the soils in this district not being suitable to free volatility and permeation of fumes through the soil. Carbon bisulphide gave fairly good results, and several growers who obtained supplies of this material through the local pest destruction board reported very favourably on the results that they had secured.

There was one outstanding feature, however, that was observed by both the writer and one of the above-mentioned farmers, that followed the use of bisulphide, which was that, although immediately following fumigation a good grub-kill resulted, yet after a couple of weeks some living grubs were again noted at the cane-roots. Carbon bisulphide loses its poisonous properties after it has been in the ground for between forty and forty-eight hours, therefore this subsequent grub infestation was found to be due to a migration to the cane-roots, after the bisulphide had disappeared from the soil, of the grubs that were feeding at the grass-roots between the cane-rows at the time of fumigation. No doubt such fumigation was to a certain degree satisfactory, but it clearly showed that it was not only desirable to secure a good kill, but that it was also necessary to obtain some kind of fumigant that would effect a quick kill and then retain its poisonous, or at any rate repellent, properties for some weeks after fumigation.

This led to the carrying out of experiments with various solutions of pine tar creosote with benzine, carbon bisulphide, &c. The introduction of pine tar creosote followed the reading of a report from the Experiment Station record (1928) where it was stated that this material had been used very successfully in different mixtures as a control for borers in peach and other trees. The creosote was reported to possess lasting and penetrative poisonous qualities, therefore it was decided to run a series of experiments with it against cane-grubs.

A large number of laboratory experiments with various chemicals were carried out during the year which gave valuable information.

**Field Experiments.**

No. 1.—Pine Tar Creosote and Benzine, 10 per cent. Solution.—At Sarina, on a farm where greyback grub damage was severe and fairly extensive, a plot comprising four rows of affected cane each 30 yards in length was fumigated with ½-oz. doses (Vermorel injector) of the above solution.

**6. Work of the Division of Entomology—*continued.***

Examination made one month later revealed the presence of an occasional grub at some of the stools, but much of the adjacent control cane had fallen over. The treated cane did not show much indication of further damage. Three months after fumigation the treated cane appeared much greener and better than the surrounding cane, of which fully 50 per cent. was lying down and much of it dead. It was subsequently inferred, however, that the doses of poison had not been injected deep enough, because, unlike carbon bisulphide, the fumes of which are heavier than air and therefore percolate downwards, the benzine fumes would have a tendency to rise. Later deeper fumigation gave better results. In this plot the doses were placed on both sides of the stools, about 3 inches from the plants and to a depth of 4 inches.

No. 2.—Pine Tar Creosote and Carbon Bisulphide, 10 per cent. Solution.—On the same farm as experiment No. 1, two rows each 33 yards in length were treated with $\frac{1}{6}$-oz. doses of the above mixture. The doses were placed on both sides of the cane-stools and to a depth of about 4 inches.

Inspection carried out a month later showed the cane to have slightly recovered; an odd grub was found near but not at several stools, and these had no doubt been feeding on the grass-roots between the cane-rows. Two months later another inspection was made which showed very promising results. The fumigated cane was green and erect, and the stools on close examination were found to have formed numerous young roots. In the adjacent control block more than half the cane was lying down and withered. In this experiment the doses had apparently been injected to the correct depth; the bisulphide fumes would work downwards. It is considered that this experiment was satisfactory.

No. 3.—Pine Tar Creosote and Benzine, 20 per cent. Solution.—On the same farm as the above experiments, two rows of grub-infested cane each 30 yards in length were fumigated with $\frac{1}{6}$-oz. doses of the above solution. The doses were injected on both sides of the cane-stools and to a depth of 4 inches.

Three hours after injection two stools were dug up. Under one three grubs were found; of these two were very sickly and had their anal tracts protruding, the third one was almost dead. Under the second stool two grubs were located; of these one was cut in two whilst digging, the other one was very sickly and had its anal tract protruding. Forty-eight hours after fumigation, as requested, the grower dug up two stools and reported:—"Two stools dug up; under one only one grub found, apparently normal; under the other stool five grubs found, of these one was dead and black, the other four were practically dead and very limp." The grubs were located at depths of from 7 to 8 inches, and as the fumigant was injected to only 4 inches it was considered that it was not quite deep enough. The odour of the poison was very strong to about 5 inches but not noticeable where the grubs were found. Two months after treating the cane was observed to be decidedly better than the control block, where most of the cane was dead. In the control block grubs were then found feeding at a depth of 9 inches. This led in later experiments to the deeper injection of the fumigant.

No. 4.—Commercial Creosote and Benzine, 20 per cent. Solution.—On the same farm as the above experiments, four rows of grub-infested cane each 20 yards in length were fumigated with $\frac{1}{6}$-oz. doses of the above solution. The doses were applied to both sides of the stools and to a depth of approximately 4 inches. At the time of fumigation the ground was very dry and consolidated.

Two hours after fumigating, two stools were dug up but no grubs could be located. Forty-eight hours from the time of injecting, the farmer dug up two stools and reported as follows:—"Six grubs were found which were practically dead."

An inspection made eight weeks later showed considerable improvement in the treated cane, which was green and much more erect than the cane in the adjoining control block. This cane continued to improve till it was cut.

No. 5.—Carbon Bisulphide.—On the same farm as the above experiments and in the same block as the foregoing experiment, seven rows each 20 yards in length were fumigated with $\frac{1}{6}$-oz. doses of carbon bisulphide. The doses were placed at both sides of the stools and to a depth of approximately 4 inches.

Forty-eight hours after fumigation two stools were dug up with the following result:—Under one stool found seven grubs; four were dead and three alive. Under the other stool four grubs were found, all alive. The odour of the poison was still strong in the soil. All the grubs dug up were very deep down, from 8 to 10 inches, and the soil was hard and consolidated; therefore it would have been much better if the fumigant had been injected deeper. Probably central stool fumigation would have been more effective in this experiment, because the grubs were situated right under the stools.

No. 6.—Pine Tar Creosote and Benzine, 10 per cent. Solution.—A series of small field experiments was carried out with a view to obtaining the approximate percentages of grubs killed, and to secure data with regard to the correct depths at which to fumigate with the different mixtures employed.

A few stools were fumigated with $\frac{1}{6}$-oz. doses of the above solution; half of these were fumigated at the centres and the remainder with doses placed at both sides of the stools. Next day one stool in each half of the treated row was dug up with the following result:—Central fumigation: Three grubs; two dead, one very sick. Side fumigation: Two sick, one dead. Little difference was noticeable in the resulting kill; the doses in each case were injected to a depth of 5 inches.

No. 7.—Commercial Creosote and Benzine, 10 per cent. Solution.—This experiment was similar in every way to the foregoing, and when a stool was dug up in either half of the treated row, the next day after fumigating, the following results were noted:—Central fumigation: Six grubs; four dead, one apparently killed by

**6. Work of the Division of Entomology**—*continued.*

injector spear, one alive and lively. Side fumigation: Five grubs; two dead, three alive. A slightly better kill was obtained from the centrally injected stool.

No. 8.—Carbon Bisulphide.—This experiment was similar to the above, and when stools were dug up next day the following results were observed:—Central fumigation: Seven grubs, all dead. Side fumigation: Eight grubs; four dead, four alive, and of these two were slightly affected by the poison.

No. 9.—Pine Tar Creosote and Carbon Bisulphide, 10 per cent. Solution.—Similar to the above experiments, and when stools were dug up next day the following results were noted:—Central fumigation: Three grubs, all dead. Side fumigation: Five grubs; two dead, one normal, two others cut by the spade; these were very dark, so they may have been dead before cutting.

No. 10.—Commercial Creosote and Carbon Bisulphide, 10 per cent. Solution.—Similar to the above experiments, and when examined two stools, one in each half of the row, next day, the following results were noted:—Central fumigation: Three grubs, all dead. Side fumigation: Four grubs, all dead. The fumigant in the last four experiments was injected to a depth of between 7 and 8 inches. Inspections made subsequently showed that in all the above cases the fumigated cane was considerably better than the cane in the control rows adjoining.

**Life Histories of Principal Cane Beetles Studied.**

Special attention was directed during the months of December (1928) and January (1929) to observation of the feeding, mating, and oviposition habits of the undermentioned cane beetles and associated species, in the Mackay district. Although all these species are recorded from some one or other of the more northern cane areas, their habits, as regards food and emergence in this district, differ in most species. Summarised details are given hereunder with each species.

Greyback Beetle (*Lepidoderma albohirtum* Waterhouse).—The main emergence of this species last season occurred during the first two weeks of December 1928, and the beetles remained in full force for about six weeks. They were preceded by the *frenchi* beetle flight, and it is of interest to note that in the Cairns district the greybacks usually emerge before the *frenchi* beetles; here that is reversed.

The principal feeding-trees have proved to be almost similar in range of importance with the feeding-trees of this beetle in the far North—wild figs (*Ficus* spp.), of which the well-known Banyan fig, rough-leaved (*F. opposita*) cluster fig, and the cultivated weeping fig (*F. benjamini*) are examples. Moreton Bay ash (*Eucalyptus tesselaris*) and blue gum (*E. tereticornis*) are commonly fed upon in the forest country; and in the swampy ground, usually near scrubs and creeks, the beetle tree (*Philanthus* sp.) is much favoured, chiefly towards the end of the flighting season. Many other trees principally in scrubs, in addition to the above, are attacked to a more or less serious extent. Many cultivated shrubs and trees such as coconut palms, bananas, &c., are also fed on.

Many female beetles were caged and eggs obtained from them. The maximum number laid by one beetle was 36, and the average time for incubation was found to be between fifteen and seventeen days. Grubs remained in the first stage for about five weeks, in the second stage for about six weeks, and in the third stage from about the months of March until June or even July. At the present time some beetles have emerged from their pupal cases and are resting in their cells (October). With the advent of favourable early rains this summer the beetle flight should also be early.

Frenchi Beetle (*Lepidiota frenchi* Blkb.).—Two distinct emergences of this beetle occurred last season, the first one early in November 1928, and the other one at the end of the same month and early December. Caged female beetles laid freely, as many as twenty-six eggs being obtained from one specimen. The incubation period averaged from sixteen to seventeen days. The resultant grubs from this flight reached the third stage last month (September 1929), the intermediate time being spent in the first and second stages. These grubs will be beetles in the 1930-31 summer, this species having a two years' life-cycle.

Dusky Cane Beetle (*Dasygnathus australis-dejeani* Boisd.).—This species was bred through to the beetle stage from second-stage grubs obtained in the earlier part of 1928, and the writer was successful in getting these bred beetles to mate and lay eggs in confinement. The largest number of eggs obtained from one female beetle was fifteen; the eggs were deposited singly in the soil, and each one was enclosed within a small nodule of earth. The period of incubation lasted from ten to eleven days only. By the end of June 1929, almost all the grubs from these eggs had reached the third stage or formed their pupal cells. The pupal period lasted for about three weeks. Fully developed beetles of this species were noted about a week ago in canefield soil at the Experiment Station. Grubs of this beetle were very plentiful in some places in 1928; this year they have not been nearly so abundant.

Christmas Beetle (*Anoplognathus boisduvali* Boisd.).—This beetle appeared in full flight during December 1928, when its principal feeding-trees were noted to be blue gum (*E. tereticornis*) and the common guava. In some places many of the latter trees were practically stripped of all their leaves by this beetle and the "allied Christmas beetle." (See next description.) In the Cairns district the favourite feeding-tree of this insect is the swamp or poplar gum (*E. platyphylla*), and the writer obtained large numbers at the Tully in 1926 from the leaves of river myrtles (*Eugenia tierniana*). The diet of this species is therefore varied in different districts.

From caged female beetles the greatest number of eggs obtained from one individual was eighteen, and these were laid singly in the soil without any enclosing pellet of earth round them. Incubation averaged from fourteen to seventeen days. Grubs had reached the third stage by June and were pupæ in August and September. The pupal period was found to occupy from twenty-one to twenty-four days.

**6. Work of the Division of Entomology—*continued.***

Allied Christmas Beetle (*A. porosus* Dalman).—This beetle much resembles in general appearance the foregoing species, and was taken freely in company with that insect from blue gum trees (*E. tereticornis*) and guava bushes. The chief distinguishing features between the species are that the allied Christmas beetle is slightly smaller and more rounded, and more deeply burnished in colour. The back is minutely black-dotted instead of a distinct black lining as in the Christmas beetle. The maximum number of eggs laid by one female beetle in captivity was seventeen, and these were laid singly in the soil without any enclosing pellet of earth round them. The incubation period lasted from twelve to fourteen days. The grub stages are very similar to those of the Christmas beetle both in general appearance and in the times spent in the stages of development. So far it seems practically impossible to identify third-stage grubs of this species with absolute certainty.

Anomala Beetle (*Anomala australasiæ* Blkb.).—This smaller blue-black bronzy beetle was in full flight during December 1928, and, as in the Northern cane areas, it was collected chiefly at dusk from flowers of lantana, duranta, and frangipanni. Occasionally on dull days the beetles remained on the flowers during the daytime. One caged female beetle laid the large number of thirty-four eggs, and from these the young grubs emerged within twelve days. The eggs were laid loosely in the soil with apparently no enclosing nodule of earth round them. Grubs of this beetle grow very rapidly, some being noted in the third stage ten weeks after the flighting of the beetles. Pupal cells were formed by May 1929, just five months after the beetles flew. It was, however, observed that these grubs remained in the prepupal state for from four to nearly five months before actually transforming into pupæ. The pupal stage was found to occupy a period of from eighteen to twenty days.

Large Southern Cane Beetle (*Lepidiota trichosterna* Lea).—Grubs of this beetle were forwarded to the writer by Mr. R. W. Mungomery, the Assistant Entomologist at the Bundaberg Sugar Experiment Station, during May 1928, and in breeding these through to the adult stage the following data were obtained:—The third-stage grubs continued to feed until July, when they entered their pupal cells early in August. The actual change into pupæ occurred about early October, and about twenty-eight days on an average were spent in that stage. The adult beetles lived for nearly three months with apparently no food. Pairs were caged, and one pair mated about the middle of December and on 31st December, 1928, twenty eggs were laid by the female. These were laid loosely in the soil, and their period of incubation occupied fourteen days. Grubs from these eggs remained in the first stage until March, and in the second stage until May (1929). Probably under field conditions the duration of these stages would have been much shorter.

Golden Beetle (*Calloodes mastersi* Macleay).—The life history and habits of this beetle were hitherto little known until observed by the writer during the past season. It was definitely established that grubs of this beetle do feed at cane-roots, both from observations made in the laboratory as well as in the field. At the latter end of February 1928, grubs of this insect were taken under cane-stools at the roots; they were then not known, and when bred through proved to be this species. The beetles are recorded as occurring plentifully in the Ingham district, where they feed on pink burr; in the Mackay district about Christmas time the beetles congregate in large numbers on the foliage of the prickly cork tree or "bat-wing leaf" tree (*Erythrina vespertilio*), and they often completely defoliate these trees. The beetles are very active, especially in sunshine. Mating occurs during daylight on the feeding-trees, the male resting on the back of the female. Mated female beetles were caged, and the greatest number of eggs obtained from one example was nine. The eggs were laid singly and loosely in the soil, and their incubation period lasted from eleven to twelve days. The different stages of the grubs were found to occupy approximately the following periods:—First stage, six weeks; second stage, six to seven weeks; third stage, four to five months. The fully grown third-stage grub much resembles the same stage grub of the Pentodon beetle, which is recorded as being plentiful in the Maroochy district. The pupal stage lasts about three weeks.

*Anoplognathus abnormis* Macleay.—This beetle, though not known to attack cane, was studied during the past year, and its grubs were obtained from eggs laid by caged female beetles. The feeding-tree of the beetles is a species of lillypilly (*Eugenia* sp.). One female beetle laid ten eggs which took seventeen days to hatch. The grub stages recorded to date are—First stage, January to May; second stage, May to August; third stage, not yet known; at the time of writing these grubs are still active and feeding.

Green Beetle (*Calloodes rayneri* Macleay).—Specimens of this showy beetle were collected from Moreton Bay ash (*E. tesselaris*) trees and guava bushes. No success followed experiments dealing with studies of the life history.

Blue-green Beetle or Rutelid Beetle (*Repsimus æneus* Fab.).—This beetle appeared fairly plentifully on the foliage of Moreton Bay ash trees (*E. tesselaris*) during the month of December, and was often taken whilst collecting greybacks. Experiments showed that one female beetle was capable of laying fifty-four eggs; this was the maximum number obtained from one example of a large number of caged beetles. The incubation period was found to occupy from twelve to fourteen days. The grubs spent about six weeks in the first stage, about seven weeks in the second stage, and the third stage unfortunately has not yet been fully studied, the grubs all having died almost immediately after their moult from the second stage.

*Anoplognathus pallidicollis* (Blck.).—About half a dozen examples of this species, which has also been recorded from the Bundaberg district by Mr. R. W. Mungomery (Assistant Entomologist), were taken early in December 1928 from leaves of blue gum (*E. tereticornis*). No life history data have so far been gathered.

Other breeding experiments were also made.

**6. Work of the Division of Entomology—*continued.***

**Miscellaneous.**

Farmers are requested to communicate with the Experiment Station when they note the occurrence of any outbreaks of insect pests in their canefields, and when visiting the station at any time are invited to inspect the reference collection of insects.

**Acknowledgment.**

The writer expresses appreciation of the assistance rendered by different farmers in the district who have at different times kindly made available portions of their farms for the carrying out of field experiments. The collaboration of the Mackay District Pests Destruction Board has been of great assistance, and the Secretary of the Canegrowers' Executive has many times brought under notice the occurrence of insect pests in parts of the district, which has been very helpful.

## SOUTHERN AREA (BUNDABERG).

### Report of the Assistant Entomologist, Mr. R. W. Mungomery, for the year ending 31st October, 1929.

**General.**

Insect depredations during the year under review have been of a mild nature, and, had it not been for the rather adverse growing conditions imposed on the cane plant during the spring months, these losses would have been even smaller. Scarabæid grubs continue to give trouble in Childers and in a few parts of the Bundaberg district. At Childers, in some instances, young cane was affected and there were a few cases of poor strikes through this cause.

**Experiments with Coloured Lights against Cane Beetles.**

Following on experiments which had previously shown the futility of using the ordinary yellow kerosene and acetylene lights as a means of attracting female specimens of the Childers cane beetle (*Pseudholophylla furfuracea*) during its flighting season, coloured lights were used last year with a view to ascertaining whether their use was attended by any marked advantage over the use of the ordinary yellow lights previously mentioned. For the purpose of this experiment, red, dark blue, pale blue, and green lights were used. Counts made on different nights of the numbers of beetles attracted to each light proved that no light in particular showed any superiority for this kind of work over another, and results were similar to those already obtained when experimenting with yellow lights. Coloured light traps, therefore, cannot be considered of any real value in the control of this beetle.

**Use of Lights in Controlling Cane Beetles.**

In these southern districts, lights are now recognised as being valuable chiefly as a means of locating mating pairs of beetles, so that they can be readily collected from the objects from which they are suspended. *Frenchi* cane beetles (*Lepidiota frenchi*) particularlly lend themselves to being collected in this manner, since they fly to low shrubs and fences and remain suspended therefrom while mating. When such collecting is carried out in the vicinity of canefields, this exercises a profound decrease in the incidence of grubs in these fields in following years. With reference to the species *P. furfuracea* and *Lepidiota trichosterna*, their habits are such that mating takes place on the ground soon after emergence, and moreover, since they are both of a reddish brown colour, they do not contrast well with the red soils in which they are usually found. Consequently, the collection of beetles under these circumstances is a most difficult operation, and in thickly infested fields the most experienced collectors have difficulty in collecting 100 female specimens during the hour's flight. Accordingly this method, in the case of the two latter species, cannot be considered as being worthy of more general adoption.

**Cane Grub Destruction.**

Since the information at our disposal, as the result of investigation carried on up to the present time, leads us to the belief that little hope can be entertained of controlling the pest in its adult stage, I have continued with methods of attacking the insect in its larval stages, and this has taken the form of two distinct lines of attack, namely (1) by the use of fumigants, stomach poisons, &c., and (2) by means of biological control.

Fumigants, Poisons, &c.—Carbon bisulphide and paradichlor. have both been used extensively, and it is highly probable that the more favourable position of the grub problem during the past year in the Isis district is in a large measure due to their continued use over the last two to three years. Although they are the most successful fumigants we have for this class of work, they do not always stand up to the severe condtiions imposed on them during the winter months. Often we find grub damage showing in early June, when the cane is 4 to 5 feet in height, and at that time grubs are located at varying depths in the soil, and in failing to kill grubs located at the lower levels this is where these fumigants prove inefficient. Soil temperatures throughout the winter months are seldom more than 60 F., and, with the high south-easterly and westerly winds which alternately prevail throughout this period, the rate of diffusion of any gas formed from the vapourisation of these chemicals is very rapid. Particularly is this the case with paradichlor., and it seems that the liberation of the toxic vapours of this chemical is not fast enough to effect a kill before the grubs can travel outside of its influence. With carbon bisulphide the radius of spread of the gas is greatly reduced in the winter, and to be efficient a much larger quantity is required for winter treatment, thus making the cost of application almost prohibitive. These chemicals are therefore most effective in the hot spring and summer months, when, after a period of rain, the grubs are feeding nearer to the surface of the soil.

Whilst dealing with the subject of fumigants, it may be mentioned here that the necessity has always been recognised of finding a suitable chemical, which, when placed with or near a cane-set, will guarantee to the plant immunity from the attack of soil insects, and at the same time have no ill-effects on subsequent plant

**6. Work of the Division of Entomology—*continued.***

growth. Such a chemical is required owing to the fact that, in certain localities, sets that are planted as "misses" are repeatedly destroyed, and it is almost impossible to secure a strike. Several such germination tests with various fumigants and poisons have been carried out, but in nearly all cases the check in growth has been too severe to warrant their being used for this purpose.

Biological Control.—Every endeavour is being made to increase the effectiveness of the many natural enemies that attack our scarabæid grubs, and any matter that militates against their normal increase is being looked into. Reference was made in last year's annual report to the fact that it is very common to find scores of birds following ploughs and eating insects that are exposed by the discs. The chief birds concerned are the Indian mynah (*Acridotheres tristis*), the peewit (*Grallina picata*), and the common crow (*Corvus marainæ*), and undoubtedly they destroy great numbers of grubs annually. However, where parasitic and predaceous insects occur in conjunction with cane-grubs, the two former birds are just as eager to include the beneficial insects in their diet, as the harmful species. In fact, in some instances they would appear to discriminate in favour of certain predaceous insects, and an examination of the stomachs of several birds that were shot to investigate this matter showed that as many as twelve beneficial insects had been eaten during the time in which the same bird had eaten four grubs. The original plan formulated to investigate this matter was to examine the stomachs of these birds monthly over a period of a year. This, however, could not be carried out owing to the fact that it was not always possible to locate farms that were being ploughed, and on which parasites were well established; and so the question could not be dealt with exhaustively. According to our present knowledge of the position occupied by birds, in regard to whether or not they contribute in any way towards ameliorating the cane-grub problem in the Isis district, it seems that on farms where beneficial insects are well established these birds do more harm than good, and in such cases they might be scared away by means of a scarecrow or a report from a gun. On other farms where cane-grubs alone are found, obviously birds can only do good by their attention to these soil-frequenting insects, and they should be encouraged in every possible way.

Entomogenous Fungi.—Under certain circumstances, grubs are sometimes found killed by entomogenous fungi, and it is thought that, although these fungi occur naturally in the soil and cause severe mortality in localised patches, they are not sufficiently widely distributed to appreciably affect the grub population over a wide area. An attempt is being made to cultivate the fungus artificially and distribute the spore-bearing material on the fields prior to planting. At present, several fungi have been isolated from grubs found dead in the soil, and experiments are in progress to determine the species responsible for the death of these grubs.

**New Sugar-cane Pest** (*Crambus malacellus* Dup.).

Caterpillars of this moth were found to be damaging young Badila ratoons last year towards the end of November. Their method of attack was to bore into the young shoots near the ground level and in this manner they produced "dead hearts." The damage was almost identical with that inflicted by the more common moth borer *P. truncata*, although the cane attacked was usually smaller than that harbouring the latter borers. In addition the larvæ construct silken galleries and web together particles of earth, vegetable matter, and other debris, and they retire into these galleries when they are not feeding. This moth has been recorded from Australia for many years past, and it is probably indigenous to this country and a feeder on some of the native grasses. Infestation was limited to only a very small percentage of the crop, so that it is considered of minor importance. Moreover it is not considered that it will ever attain serious proportions, and the abnormal dry spring with its consequent poor growth of native grasses may have been responsible for the moth ovipositing on the young ratoons.

## 7.—Work of the Division of Sugar Mill Technology.

### REPORT BY MR. NORMAN BENNETT, SUGAR TECHNOLOGIST, FOR YEAR ENDING 31st OCTOBER, 1929.

#### Organisation.

During the past year, the work of the division has been carried on by the Mill Technologist. Pending final arrangements for the establishment of a laboratory, no further additions to the staff were made during the year, and the work of the division has been continued along the original lines set out in the first annual report, viz., the continuance of mill-to-mill inspection visits during the crushing season.

Owing to the number of mills to be visited, the time taken to complete mill-to-mill inspections is three months. In some cases, only one visit can be made during the crushing period. Adequate time for the investigation of particular problems at individual mills has therefore been impossible.

Arrangements have now been made for the erection of an adequately equipped laboratory at the Mackay Sugar Experiment Station, which will be made the permanent headquarters of the division. It is proposed to commence investigational and research work early in 1930.

It is proposed that the staff of the division be increased to undertake this work and the ultimate organisation of the division extended to include—

1. Mill Technologist,
2. Associate Mill Technologist,
3. Sugar Engineer,
4. Sugar Chemist,

and it is hoped to do this by the appointment of University graduates in the faculties of Applied Science and in Engineering. It is anticipated that the Technological Division of

**7. Work of the Division of Sugar Mill Technology**—*continued.*

the Bureau will eventually maintain a supply of well-trained University graduates to fill the responsible positions in the sugar industry.

In order to accomplish this object without impairing the working efficiency of the division, it is essential that close co-operation between the mills and the Bureau be firmly established. In last year's report, the following first essentials for a serious organised effort to improve milling efficiency were given:—

1. Standardised methods of sampling and analysing all products of manufacture;
2. Use of a uniform method of calculating reports for comparative purposes;
3. Frequent interchange of working reports between mills;
4. Annual meetings of mill executives to discuss manufacturing problems based upon working operations of the preceding season.

The efforts made by the division during the past year towards these aims have been well supported by the majority of the mills. For the first time an averaged summary of the work of the mills has been made in Queensland, and the figures are included in this report.

### Scheme for Mutual Control.

Modifications of various schemes for the collection of mill data are now in use in most of the important cane-sugar producing countries. The International Society of Sugar-cane Technologists has appointed a sub-committee to standardise the various methods of reporting and calculating mill data with a view to preparing a yearly comparative report of the work of different countries. The first report of this committee on General Definitions and Milling Control has been published in La. Planter, 24th August, 1929, and in the International Sugar Journal of September 1929.

A scheme for the mutual control of Queensland mills is being prepared by this division on the lines recommended by the International Committee. The replies received from the mills to the circular setting out the lines of the proposed scheme have been satisfactory, and the fortnightly distribution of mill results will be undertaken by the division at the commencement of the 1930 crushing season.

### Queensland Society of Sugar-cane Technologists.

An invitation to the mills to attend a conference for the discussion of manufacturing problems was issued early in the year. The conference was held in Mackay on 12th-16th March, and was attended by representatives of sixteen mills, six engineering firms, and representatives from the Cane Prices Board and the Bureau of Sugar Experiment Stations.

At the conclusion of the conference, the meeting unanimously decided to form a Queensland branch of the International Society of Sugar-cane Technologists. This society will continue the system of annual meetings for the discussion of technical problems. The next meeting of the society will be held in Cairns, commencing 3rd April, 1930.

In view of the importance of the Java meeting of the International Society of Sugar-cane Technologists to the Queensland industry, a deputation from the Mackay meeting waited on the Minister for Agriculture and urged that the newly formed society be represented at the Java conference by a representative of the Bureau.

A report of the Mackay conference has been prepared by the Bureau for the society, and was distributed to all mills at the end of May.

### Report of Mill Work for Season 1929.

Crushing for the season 1928 was commenced by some of the Northern mills during the first week in May and was completed by the mills with one exception before the end of December. Thirty-five mills were in operation during the crushing season; the highest seasonal tonnage being 252,648 tons by Victoria mill in the Herbert River district, and the lowest 400 tons by the small plant at Alberton in the Beenleigh area.

In all, a total tonnage of 3,736,683 long tons of cane was crushed to produce 520,620 long tons of 94 net titre sugar. The average tons of cane per ton of 94 n.t. sugar, viz. 7·18, is the lowest figure recorded to date for any cane-sugar producing country. The cane required to make a ton of sugar has been gradually decreasing over a period of years, as is shown by the following table:—

| Year. | Tons Cane p.t. Sugar. |
|---|---|
| 1920 .. .. .. .. | 8·0 |
| 1921 .. .. .. .. | 8·11 |
| 1922 .. .. .. .. | 7·53 |
| 1923 .. .. .. .. | 7·60 |
| 1924 .. .. .. .. | 7·75 |
| 1925 .. .. .. .. | 7·55 |
| 1926 .. .. .. .. | 7·52 |
| 1927 .. .. .. .. | 7·32 |
| 1928 .. .. .. .. | 7·18 |

For the season now nearing completion there is every indication that the figure for the 1929 season will be reduced below that of 1928. Owing to lack of records, it is not possible to draw a comparison of the average purity of the first expressed juice of the cane milled for past years, but there is no doubt that increasing efficiency in mill-work has been responsible for some of the decrease.

The present tendency in Queensland milling practice is towards increased tonnages per hour, and this higher tonnage has been obtained without any sacrifice in mill-work. The higher weekly tonnages have resulted in the harvesting of the crop during the periods of highest sugar content, which has had a marked effect on the tons of cane required to make a ton of sugar.

The sugar industry in Queensland is carried on in a long, narrow strip of coastline, about 1,000 miles in length, with widely varying climatic conditions of rainfall, temperature, and cane varieties. For the purpose of the reports of this division, it is proposed to subdivide the sugar areas into three districts—

1. The Northern district, comprising that area north of the 19th parallel of latitude south. No cane is grown in the area above latitude 16 S
2. The Central district, comprising a scattered cane area between latitude 19 S. and the Tropic of Capricorn.
3. The Southern district, comprising the area between the Tropic of Capricorn and latitude 28 S.

## 7. Work of the Division of Sugar Mill Technology—*continued.*

The following table gives the district results for the 1928 crop:—

| District. | Number of Mills. | Tons of Cane. | Tons of 94 n.t. Sugar | Tons Cane p.t. 94 n.t. Sugar. |
|---|---|---|---|---|
| Northern | 10 | 1,863,878 | 255,188 | 7·33 |
| Central | 12 | 1,266,810 | 184,343 | 6·87 |
| Southern | 13 | 605,995 | 81,089 | 7·47 |
| | 35 | 3,736,683 | 520,620 | 7·18 |

TONNAGES CRUSHED BY MILLS, 1928 SEASON.

| Mill. | Tons Cane Crushed. |
|---|---|
| Mossman | 78,542 |
| Hambledon | 181,511 |
| Mulgrave | 189,749 |
| Babinda | 194,259 |
| Goondi | 173,888 |
| South Johnstone | 179,606 |
| Mourilyan | 161,794 |
| Tully | 230,424 |
| Victoria | 252,648 |
| Macknade | 221,457 |
| Total, Northern District | 1,863,878 |
| Invicta | 76,494 |
| Pioneer | 123,864 |
| Kalamia | 159,998 |
| Inkerman | 165,533 |
| Proserpine | 120,635 |
| Farleigh | 92,980 |
| Racecourse | 91,381 |
| North Eton | 66,275 |
| Cattle Creek | 49,190 |
| Marian | 88,386 |
| Pleystowe | 108,994 |
| Plane Creek | 123,080 |
| Total, Central District | 1,266,810 |
| Millaquin | 94,980 |
| Qunaba | 43,756 |
| Fairymead | 83,571 |
| Bingera | 96,298 |
| Isis Central | 88,110 |
| Gin Gin | 30,453 |
| Childers | 82,962 |
| Maryborough | 22,162 |
| Mount Bauple | 24,202 |
| Moreton | 35,364 |
| Eagleby | 622 |
| Alberton | 400 |
| Rocky Point | 3,126 |
| Total, Southern District | 605,995 |

**Average Figures for Mill Work, 1928 Season.**

| | Northern. | Central. | Southern. | Total. |
|---|---|---|---|---|
| Tons cane | 1,863,878 | 1,266,810 | 605,995 | 3,736,683 |
| Tons cane p.t. 94 n.t. sugar | 7·33 | 6·87 | 7·47 | 7·18 |
| Fibre | 10·80 | 13·39 | 14·48 | 12·50 |
| Pol. per cent. cane | 15·22 | 16.03 | 14·82 | 15·42 |
| Bagasse— | | | | |
| Moisture | 54·98 | 51·0 | 51·1 | 52·6 |
| Pol. | 2·93 | 3·52 | 2·77 | 3·12 |
| Sugar— | | | | |
| Pol. | 98·19 | 98·39 | 98·63 | 98·36 |
| Moisture | 0·46 | 0·40 | 0·26 | 0·40 |
| Gallons Molasses p.t. cane | 4·35 | 4·12 | 4·31 | 4·27 |
| Gallons Clarified Juice p.t. cane | 219 | 223 | 236 | 223 |
| Purities— | | | | |
| 1st Exp. Juice | 88·32 | 89·82 | 89·57 | 89·11 |
| Clarified Juice | 88·0 | 88·92 | 88·78 | 88·47 |
| Syrup | 88·15 | 89·69 | 89·06 | 88·88 |
| Bx. Syrup | 68·8 | 66·2 | 67·7 | 67·86 |
| Pol. in Sugars— | | | | |
| Per cent. Pol. in cane | 86·76 | 86·97 | 85·32 | 86·57 |
| Pol. Extraction | 94·98 | 93·41 | 94·04 | 94·19 |
| Extraction Ratio | 0·481 | 0·492 | 0·411 | 0·464 |
| Milling loss | 7·08 | 7·89 | 6·19 | 7·17 |
| Pol. in Sugars— | | | | |
| Per cent. Pol. in Mixed Juice | 91·33 | 93·10 | 90·72 | 91·91 |

NOTE.—These figures have been averaged from the results sent in by the mills. No results are included of the C.S.R. Co.'s mills or Invicta, Pioneer, Inkerman, Maryborough, and Bauple, from whom no figures were received, other than tons of cane and tons of sugar crushed. The results have been averaged for six mills in the Northern district, nine mills in the Central district, and eight mills in the Southern district. Two of the small mills in the Southern district make no attempt at chemical control.

**7. Work of the Division of Sugar Mill Technology**—*continued.*

Prior to the commencement of the 1928 season, the mills received notice that the strength of the sugars to be made was to be decreased owing to the increased import tariff placed on sugar of over 99 pol. entering the United Kingdom. Prior to the 1928 season it had been the practice of Queensland mills to manufacture a sugar of over 99 pol.

This was accomplished by steam washing of the massecuites, and the lowering of the polarisation of the sugars resulted in many initial difficulties for the first weeks of the season. Some mills are still experiencing difficulty with short bag weight and hard sugar. The results obtained at some of the mills, particularly Racecourse and Mossman, show that these difficulties can be overcome by closer attention to the moisture content of the sugar and to the grain size of the massecuite.

With the lower polarisations of sugar now required, it is necessary that closer supervision be given to the panwork in order to obtain a medium-sized, even-grained massecuite. In most Queensland mills the fugal capacity for No. 1 sugars has been increased at the expense of the low-grade station. With increasing tonnages, the work of the crystallisers and low-grade fugals is pushed at the expense of higher-purity final molasses. Without increasing present crystalliser capacities, a trial of water-cooled crystallisers to reduce the crystalliser cycle is justifiable.

Other than the difficulties experienced with the lower grade of sugar, very little trouble was experienced with the processes of manufacture. Although gummed cane was milled in the Southern district, the quantity was not sufficient to affect the working of the plants except in the case of Qanaba.

The most important developments of the 1928 season were the increased tonnages per hour at the Northern mills and the marked reduction in the amount of wood burned per ton of sugar. During the present season, more attention to fuel economy has been given in the Northern district, and at least three of the mills—South Johnstone, Babinda, and Mossman—have had weekly crushings without using surplus fuel other than bagasse and molasses.

Development of By-Products.—The total output of molasses for the season amounted to 16,873,372 gallons, of which 3,500,000 gallons were run to waste. The remainder, about 80 per cent., was used as follows: —

| | Gallons. | % Total. |
|---|---|---|
| Sold to distilleries .. | 5,103,471 .. | 30.2 |
| Burnt as fuel .. .. | 5,131,726 .. | 30.4 |
| Food for stock .. | 2,524,136 .. | 14.9 |
| Used as manure .. | 7,200 .. | — |
| Otherwise used .. | 573,350 .. | 3.4 |

Compared with previous years the percentages are—

| — | 1925. | 1926. | 1927. | 1928. |
|---|---|---|---|---|
| Sold to distilleries .. .. .. .. .. | 18·8 | 21·6 | 28·4 | 30·2 |
| Burnt as fuel .. .. .. .. .. .. | 19·0 | 17·3 | 20·2 | 30·4 |
| Food for stock .. .. .. .. .. .. | 11·9 | 19·2 | 16·0 | 14·9 |
| Used as manure .. .. .. .. .. | 9·0 | ·6 | 3·0 | .. |
| Otherwise used .. .. .. .. .. .. | 1·7 | ·9 | 2·0 | 3·4 |
| Run to waste .. .. .. .. .. .. | 39·6 | 40·4 | 30·4 | 21·1 |

Molasses as Fuel.—All the Northern mills, with the exception of some two or three which ship molasses to distilleries in the South, burnt molasses as fuel in the furnaces without any serious trouble in clinkering. In the Mackay area, one mill, Marian, utilises molasses as fuel. Many of the other Queensland mills have attempted to burn molasses with no good result owing to clinkering in the fires. This seems to be due to the nature of the ash itself, which is composed of salts with high potash and soda content. Marian mill returns primary mud on the mills, and the extra lime has a decided beneficial effect in reducing the clinkering trouble.

Experiments carried out in Java in 1923 showed that when burning molasses alone it was possible to evaporate 2·1 lb. of water by burning 1 lb. of molasses of 89·5 brix in a special furnace. The boiler efficiency of the furnace was 50 per cent.

No published record of the calorific value of Queensland molasses has been made, and an investigation on this matter is to be made by the division in the near future.

**Power Alcohol.**

The quantity of molasses used for the manufacture of spirit has been increasing. Whilst there does not at present appear to be any market in Australia for large quantities of industrial alcohol, there has always been a small sale for molasses for the manufacture of methylated spirits and rum.

The establishment of a factory for the manufacture of power alcohol at Sarina was completed two years ago, and after extensive experiments a product was put on the market in March of this year under the name of "Shellkol." The product is a mixture of shell benzine and absolute alcohol. The mixture has been in use in the car at the Mackay Experiment Station for some months and has been found satisfactory.

**Introduction of Celotex Industry.**

The establishment of a factory for the manufacture of building board has been before the industry for five years. During the past season, representatives of the Celotex Company of Chicago, Ill., made a survey of Queensland mills with a view to selecting a site for the proposed factory. No definite agreement has yet been reached in the matter, as the price offered for bagasse was not commensurate with the value of the raw product to the mills as fuel when considered in the light of conversion costs of the boiler station from bagasse to coal.

**Artificial Silk.**

During the year considerable attention was given to the possible establishment of a factory to make artificial silk from bagasse. The scheme has since been abandoned.

## 7. Work of the Division of Sugar Mill Technology—*continued.*

### Possibilities of Secondary Industries.

With the gradually diminishing prices obtained for raw sugar in Queensland, attention has been given to various schemes for the use of the by-products of the industry. It should be remembered that the requirements of the Australian market for such materials as building board, artificial silk, industrial alcohol, and methylated spirits is limited. Actually the problem of utilisation of the by-products of the sugar industry are not technical but are fundamentally economic. Before any extension of these secondary industries can take place, a sure market must be developed for the finished article.

For the present, better financial stability can be obtained by applying the results of concentrated efforts to reduce the cost of producing a ton of sugar. The results obtained in the mills during the 1928 season in regard to increased weekly tonnages and reduction of fuel costs, at one time a serious item in many mills, are gratifying.

## 8.—Review of the Industry in 1928.

The sugar produced last year was the highest in tonnage yet manufactured, reaching 520,620 tons of 94 net titre sugar.

The yields of cane and sugar per acre in the different areas of Queensland in 1928, according to the Registrar-General, were as under:—

| District. | Tons of Cane per Acre. | Tons of Sugar per Acre. |
|---|---|---|
| Mossman to Ingham .. .. | 19·82 | 2·71 |
| Ayr .. .. .. .. | 23·21 | 3·42 |
| Proserpine .. .. .. | 12·76 | 1·78 |
| Mackay .. .. .. .. | 13·20 | 1·94 |
| Bundaberg, Gin Gin, &c. .. | 13·40 | 1·79 |
| Maryborough, Childers, &c. .. | 15·42 | 2·07 |
| Nambour to Beenleigh .. .. | 12·77 | 1·70 |

The lowest tonnage of cane required to make one ton of sugar in 1928 was 6·78 in the Ayr district, and the highest 8·73 at Beenleigh.

The Registrar-General reports that the average acreage grown by planters in Queensland is as under:—

| | Acres. |
|---|---|
| Cairns to Townsville .. .. .. | 53 |
| Townsville to Mackay .. .. .. | 45 |
| Bundaberg to Bauple .. .. .. | 29 |
| Maroochy (Nambour) to Logan (Beenleigh) .. .. .. .. | 8 |

This brings the average acreage per farmer to 40, which is an increase over 1927 of 2 acres. The number of plantations of 5 acres and over is given as 6,502, and under 5 acres as 647, making a total of 7,149 plantations, which is a smaller number than in 1927.

The number of sugar mills in Queensland remains the same, viz., 35. There are also two refineries, one in Brisbane and one at Millaquin. Other refineries are situate at Sydney, Melbourne, Adelaide, and Perth.

The value of the Australian output in 1928 is given as £11,894,311.

### Molasses Produced.

By inadvertence the molasses return for 1927 was not included in the 1928 Annual Report. It is therefore now given with the 1928 output:—

| How disposed of. | 1927. | 1928. |
|---|---|---|
| | Gallons. | Gallons. |
| Sold to distilleries .. .. | 4,509,439 | 5,103,471 |
| Burnt .. .. .. | 3,204,997 | 5,131,726 |
| Used or sold for feed .. | 2,523,390 | 2,524,136 |
| Sold, other purposes .. | 314,289 | 573,350 |
| In stock .. .. .. | 1,335,366 | 488,600 |
| Manure .. .. .. | 473,260 | 7,200 |
| Run to waste .. .. | 3,495,063 | 3,044,889 |
| Totals .. .. | 15,855,804 | 16,873,372 |

### Estimated and Actual Yields of Cane, 1928.

The following table shows the amount of cane which was estimated by the mills to be crushed in October 1928, compared with their final returns for the purpose of assessment:—

| Mill. | Approximate Estimate furnished by Mills at end of October 1928. | Tonnages actually Crushed at end of Season 1928. |
|---|---|---|
| Mossman .. .. .. | 78,542 | 78,542 |
| Hambledon .. .. .. | 180,000 | 181,511 |
| Mulgrave .. .. .. | 188,000 | 189,749 |
| Babinda .. .. .. | 190,000 | 194,917 |
| Goondi .. .. .. | 175,000 | 173,888 |
| South Johnstone .. .. | 178,000 | 179,606 |
| Mourilyan .. .. .. | 160,000 | 161,794 |
| Tully .. .. .. | 227,000 | 230,424 |
| Victoria .. .. .. | 259,000 | 252,648 |
| Macknade .. .. .. | 225,000 | 221,456 |
| Invicta .. .. .. | 83,000 | 76,494 |
| Pioneer .. .. .. | 122,500 | 123,864 |
| Kalamia .. .. .. | 158,000 | 159,998 |
| Inkerman .. .. .. | 171,000 | 165,533 |
| Proserpine .. .. .. | 130,000 | 120,485 |
| Cattle Creek .. .. .. | 52,000 | 49,230 |
| Racecourse .. .. .. | 93,000 | 91,350 |
| Farleigh .. .. .. | 94,000 | 92,943 |
| North Eton .. .. .. | 67,500 | 66,216 |
| Marian .. .. .. | 90,000 | 88,387 |
| Pleystowe .. .. .. | 110,000 | 108,995 |
| Plane Creek .. .. .. | 124,000 | 122,425 |
| Qunaba .. .. .. | 44,000 | 43,756 |
| Millaquin .. .. .. | 94,600 | 94,980 |
| Bingera .. .. .. | 98,000 | 96,298 |
| Fairymead .. .. .. | 83,500 | 83,581 |
| Gin Gin .. .. .. | 30,000 | 30,452 |
| Childers .. .. .. | 87,600 | 82,962 |
| Isis .. .. .. | 87,000 | 88,110 |
| Maryborough .. .. | 22,417 | 22,162 |
| Mount Bauple .. .. | 24,000 | 24,202 |
| Moreton .. .. .. | 37,000 | 35,364 |
| Rocky Point .. .. | 3,000 | 3,126 |
| Alberton .. .. .. | 400 | 400 |
| Eagleby .. .. .. | 622 | 622 |
| Totals .. .. | 3,767,681 | *3,736,370 |

* This agrees fairly closely with the Registrar-General's figures, which were 3,736,311. A later return furnished to the Sugar Technologist in September 1929 gives the total as 3,736,683.

## 9.—General.

### Cane Harvesters.

Further experiments are being made with mechanical means for cane-cutting. The Miller-Owen Cane Harvester at Mackay is in course of development, and shows considerable promise. The ground-cutting at a recent demonstration was excellent and the topping good. Further capital is required to enable the machine to undertake a sustained trial in the field.

Another cane harvester, designed by Mr. A. C. Howard, of Sydney, was recently demonstrated by Mr. W. Douglas, of Oakwood, Bundaberg. Reports on this machine say the ground-cutting was perfect and the topping done well.

Both machines, however, must be subjected to severe trials for many days in the field before judgment can be given.

No trials were conducted of the Falkiner Cane Harvester during the present season.

### C.C.S. Formula.

For the use of foreign readers of this report the formula used for arriving at the commercial cane sugar (c.c.s.) in Queensland cane is given—

$$\text{Total soluble solids in juice} \times \frac{100 - (3 + \text{Fibre})}{100} = \text{total soluble solids in cane.}$$

$$\text{Sucrose in juice} \times \frac{100 - (5 + \text{Fibre})}{100} = \text{sucrose in cane.}$$

Total soluble solids in cane — sucrose in cane = impurities in cane.

$$\text{Sucrose in cane} - \frac{\text{Impurities in cane}}{2} = \text{commercial cane sugar.}$$

### Balance-sheet.

STATEMENT OF RECEIPTS AND DISBURSEMENTS FROM 1ST JULY, 1928, TO 30TH JUNE, 1929.

| Receipts. | £ | s. | d. |
|---|---|---|---|
| 1928. 1st July— | | | |
| To Balance .. .. .. .. | 8,998 | 16 | 8 |
| 1929. 30th June— | | | |
| To Assessments .. .. .. .. | 11,676 | 8 | 8 |
| „ Endowment .. .. .. .. | 11,676 | 8 | 8 |
| „ Bundaberg Station .. .. .. | 461 | 18 | 7 |
| „ Mackay Station .. .. .. | 641 | 14 | 4 |
| „ Johnstone Station .. .. .. | 1,247 | 19 | 5 |
| „ Sundries .. .. .. .. | 1 | 12 | 1 |
| | £34,704 | 18 | 5 |

| Disbursements. | £ | s. | d. |
|---|---|---|---|
| 1929. 30th June— | | | |
| By Salaries .. .. .. .. | 8,347 | 1 | 11 |
| „ Wages, Travelling Expenses, Chemicals, &c. .. .. .. .. .. | 7,098 | 4 | 7 |
| „ Subsidy — Destruction Sugar-cane Pests .. .. .. .. | 1,301 | 2 | 9 |
| „ Bundaberg Contingencies .. .. | 1,259 | 0 | 5 |
| „ Mackay Contingencies .. .. | 1,959 | 0 | 1 |
| „ Johnstone Contingencies .. .. | 2,313 | 18 | 9 |
| „ Gordonvale Contingencies .. .. | 1,252 | 14 | 6 |
| „ Balance, 30th June, 1929 .. .. | 11,173 | 15 | 5 |
| | £34,704 | 18 | 5 |

Brisbane, 5th December, 1929.

H. T. EASTERBY, Director.

*Price*, 1*s*. 9*d*.]

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